PAGE'S WEEKLY.—March 31, 1905. This Paper Copy for Circulation Abroad.

No. 29. Vol. 6.
SIXPENCE.
(Registered as a Newspaper.)
FRIDAY,
MARCH 31, 1905.

PAGE'S WEEKLY

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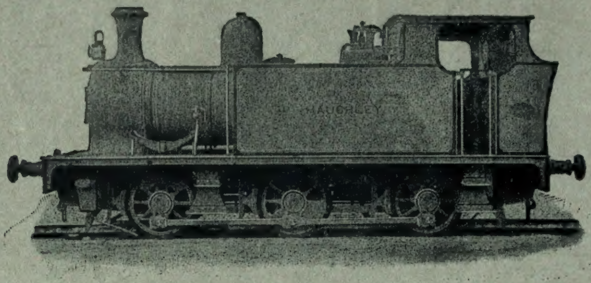
RAILWAY FOUNDRY, LEEDS.

LOCOMOTIVE ENGINES,

Of all sizes and any gauge of Railway, of greatly improved Construction, for Main or Branch Railways, Contractors, Ironworks, Collieries. Prices, Photographs, and full Specifications on application.



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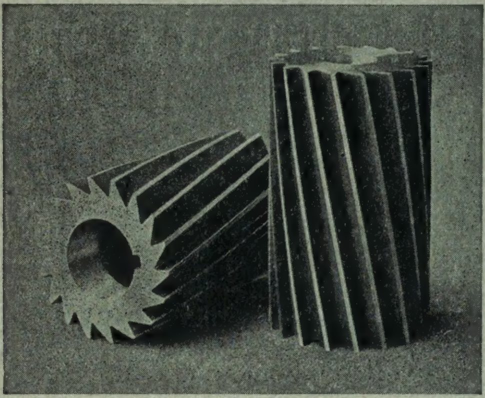
Wrought Iron throughout, Rim, Arms, and Boss.

ALSO "ETCHELLS'" NON-DRIP BEARINGS, SHAFTING, AND ACCESSORIES.



MILLING CUTTERS,

High Speed
or
Ordinary Steel.

E. G. WRIGLEY & CO., Ltd.,

Foundry Lane Works,
SOHO, BIRMINGHAM.

PATENT PAPER PINIONS

FOR NOISELESS MOTOR DRIVES.

MACHINE-CUT GEARS

OF ALL DESCRIPTIONS.

THE REID GEAR CO.,
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IN EVERY SIZE FOR HAND OR POWER USE

HACK SAW BLADES

CHARLES BAYNES

The Sole Product of a Factory.

Best English Steel throughout

WORKS:
KNUZDEN BROOK
·BLACKBURN·

PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

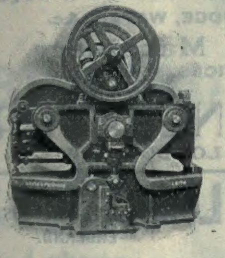
Telephone No.: 5754 Bank. Write for particulars.

ED. BRAND, *MECHANICAL ENGINEER,* 35, SHAKESPEARE STREET, MANCHESTER.

Modern Wire-Working Machinery,

Such as for Rolling, Drawing, Weaving, Netting, Forming, Automatic Straightening and Cutting, Cabling, Testing, &c.

Inquiries Solicited. Teleg. Address: "Filieres, Manchester."



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STEAM HAMMERS.

Shipbuilders' MACHINE TOOLS.

DAVIS & PRIMROSE,

Leith Ironworks, EDINBURGH.

"UNICA" SILENT GEARS

Equal in STRENGTH to, and MORE DURABLE than, Cast Iron, Gun Metal, or Rawhide.

NO SIDE PLATES OR BUSHES! UNAFFECTED BY OIL!

Have stood test of four years.

J. B. HAMILTON & CO.,

Telegrams: "Verdampfer, London." 145, Cannon St., LONDON.

Our Modelled Designs TALK! We can prove it!

ARTHUR STAFFORD & CO.,

Catalogue and Half-Tone Printers,

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See our Advertisements in last and next week's Issues.

GRAHAM, MORTON & Co. LTD.

Head Office and Works, LEEDS.

Makers and Erectors of all Classes of

CONVEYING PLANTS, COAL HANDLING PLANTS, AERIAL ROPEWAYS, &c., &c.

PAGE & ROWLINGSON,

Chartered Patent Agents.

Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*

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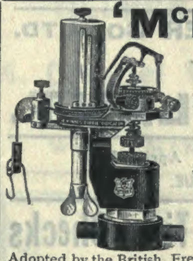
And 14, St. Ann's Square, Manchester.



'McINNES-DOBBIE' INDICATORS.

In Two types: External and Enclosed Pressure Springs.

Each made in several forms and sizes to suit all speeds and pressures.

Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

DOBBIE McINNES, LIMITED,

45, BOTHWELL ST., GLASGOW.

Adopted by the British, French, and Japanese Admiralties.

WAYGOOD LIFTS

APPLY FOR CATALOGUE.

FALMOUTH ROAD, LONDON, S.E.

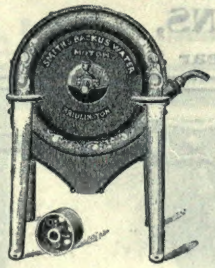
BABCOCK & WILCOX, Ltd.

PATENT WATER-TUBE BOILERS.

These Boilers are in use throughout the world to the extent of 4,700,000 h.p., generating steam for all purposes, and fired with all kinds of fuel. *See our Advertisement appearing April 14th, page 37.*

HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.

WORKS—Renfrew, SCOTLAND.



CHEAP POWER.

SMITH'S

Backus Water Motors

1/16 to 10 H.P.

Will drive any class of Machinery, and work on 15 lb. pressure.

ERIC S. A. SMITH, ENGINEER

APPLY FOR CATALOGUE. **BRIDLINGTON.**

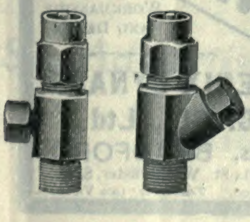
TRANSPORTERS.

See our Advertisement appearing April 14th.

TEMPERLEY TRANSPORTER CO.,

72, Bishopsgate Street Within, LONDON, E.C.

Telephone: 365 London Wall. Telegrams: "Transumo.



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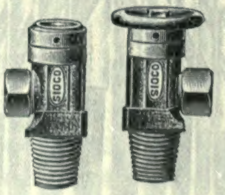
Scotch & Irish Oxygen Co., Ltd.,

ROSEHILL WORKS, GLASGOW.

Valves for Gas Bottles, Refrigerating Plant, etc., in Bronze, Steel, and Aluminium.

Reducing Valves, Keys, and all Fittings for Compressed Gases.



A

PAGE'S WEEKLY Miscellaneous

"ZECO" Brand.

Blue Planished and Glazed Steel Sheets for Lagging
and Covering generally.

ZEITZ & Co., 21, Lime St., London, E.C.

BRETT'S PATENT LIFTER Co., LTD.
COVENTRY, ENG.
Speciality—
FORGING PLANT.
See our Advertisement appearing April 14th.
SEND FOR LATEST CATALOGUE.

Brass Labels & Time Checks
Marks, Name Stamps, Branding Irons,
Sets of Letter and Figure Punches,
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Brass Name Plates, Stencil Plates,
Moulders' Letters and Figures in Great Variety.
ED. PRYOR & SON, 68, West Street, Sheffield.

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IS THE
KEYNOTE
OF OUR
ESTABLISHMENT
☞ PROVE IT BY A VISIT.

JOHN LANG & SONS,
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HARTLEY & SUGDEN, LIMITED
TRADE MARK
H & S
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Heating Apparatus
BOILERS
Wrot Welded Iron and Cast Iron
Sectional
VERTICAL STEAM BOILERS
Apply for Catalogue.

HEAD, WRIGHTSON & CO., LTD.,
STOCKTON-ON-TEES,
for all kinds of
COLLIERY PLANT & MINING MACHINERY.

SHONE PNEUMATIC EJECTORS
FOR RAISING SEWAGE, SLUDGE, WATER, &c.
Air Compressing Machinery
FOR ALL SERVICES.

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47, VICTORIA STREET, LONDON, S.W.

WALTER SCOTT, LTD.,
LEEDS STEEL WORKS, LEEDS
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MANUFACTURERS OF . . .
Rolled Steel Joists, Channels, etc.
Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds and Flats.
Speciality: TRAMRAILS.

M. GLOVER & CO., LEEDS,
SAW MILL ENGINEERS,
"IDEAL" GUARDS, BENCHES, SHARPENERS,
FIREWOOD, and LIGHTER PLANTS,
Saving in Wages alone means
A CERTAIN LARGE INCOME.

Standard of the World.
J. H. WILLIAMS & CO.,
Drop-forgings only.
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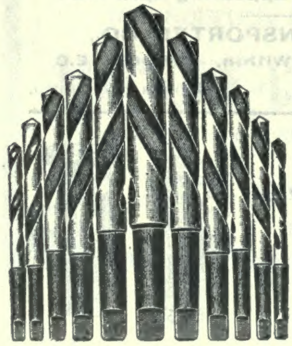


Twist Drills,
Taps,
Milling Cutters,
Reamers.

H. F. SCHNICKE,
CHEMNITZ (Saxony).

Write for Prices and Particulars
OF OUR . .
NEW "STANDARD" MACHINES.
They will interest you.

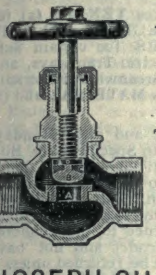
Dynamos "P.D.M." Motors

BEST MATERIAL, WORKMANSHIP, AND DESIGN.

PHŒNIX DYNAMO MFG. CO., Ltd.,
Thornbury Works, BRADFORD.
LONDON OFFICE: 17, Victoria St., Westminster, S.W.
Telegraphic Address: "Phedyna, London." *Telephone:* 1061 Victoria.

PAGE'S WEEKLY Miscellaneous

The "SHAW" Patent Steam Valves . . .



With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.

The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

Try Them! **Sent on Approval.**

☞ *Write for particulars of these and other Specialities for High Pressure Steam.*

JOSEPH SHAW, B Dept., Albert Works, **HUDDERSFIELD.**

Refuse Destructors.

Write for particulars to:—

HEENAN & FROUDE, LIMITED,

4, Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.

Contractors to H.M. Government.

BRADBURY & CO., LTD.

Capstan Lathes and Labour Saving Tools.

WELLINGTON WORKS, OLDHAM.

Lists Free.

OIL SEED AND CAKE MILLS.

GRAB DREDGERS.

OIL REFINERIES.

Rose, Downs & Thompson, LTD.,

Old Foundry, HULL,
and
12, Mark Lane, LONDON, E.C.

WATER SOFTENING PLANT.

Rochester Card
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Signature
Journey
Speed
RECORDERS.

For further particulars . . of our . .
see our whole page Ad. on April 14th.

TIME RECORDERS

RECORDERS, LTD., 171, Queen Victoria Street, LONDON, E.C.

HIGH-CLASS

NEW MACHINE TOOLS

IN STOCK FOR IMMEDIATE DELIVERY.

THOS. W. WARD, LIMITED,

ALBION WORKS,
SHEFFIELD.

Send for Catalogue (post free).

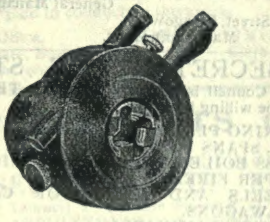
JOHN GIBBS & SON

Ventilating Engineers,

80, JUKE STREET,
LIVERPOOL.

Say Advertising does not pay

SEE OUR ILLUSTRATED ADVERTISEMENT NEXT WEEK.



HARTNESS AUTOMATIC OPENING DIE

The most satisfactory means yet devised for the production of screw threads.

JONES & LAMSON MACHINE CO.,
JUBILEE BUILDINGS,
97, Queen Victoria Street, LONDON.

PAGE'S WEEKLY Contracts

CONTRACTS.

WESTERN VALLEYS (MON.) SEWERAGE BOARD.

CONTRACT No. 1.

CONSTRUCTION OF MAIN OUTFALL AND BRANCH SEWERS.

Notice is Hereby Given that the Western Valleys (Mon.) Sewerage Board are prepared to receive **TENDERS** for the **CONSTRUCTION** of the above **WORKS**, consisting of the Main Outfall Sewer, Tank Sewer, and Sea Outfall, from Aberbeeg to low-water mark in the Bristol Channel, about 17½ miles in length varying from 2ft. 6in. to 11ft. in diameter, of brick, concrete, cast iron and steel; the Nantyglo Branch, from Nantyglo to Aberbeeg, about 6½ miles in length, varying from 12in. to 21in. in diameter, of earthenware and steel pipes; the Cwmtillery Branch, about 1¼ miles in length, 12in. and 15in, in diameter, of earthenware and steel pipes; the Ebbw Vale Branch, from Beaufort to Aberbeeg, about 8½ miles in length, varying from 12in. to 18in. in diameter, of earthenware and steel pipes; being a total length of about 35 miles, together with Penstock Chamber, Manholes, Chambers, Inspection Shafts, Ventilators, Penstocks, Storm Overflows, Connecting Chambers, and Miscellaneous Works in connection therewith.

Drawings and Specification of the Works may be seen at my offices as below, at the offices of Mr. BALDWIN LATHAM, M.Inst.C.E., Parliament Mansions, Victoria Street, Westminster, and Mr. GEORGE CHATTERTON, M.Inst.C.E., 6, The Sanctuary, Westminster.

A limited number only of the quantities, specifications, schedules, and forms of Tender are available, and may be obtained from the above Engineers, on deposit of £25 (crossed cheque only), which will be returned, after a contract has been entered into, to every person who has sent in a *bonâ fide* Tender, and has returned the documents entrusted to him.

Sealed Tenders on the forms supplied, endorsed "Tender for——— Sewerage Works, Contract No. 1," are to be delivered at my offices, 24, Stow Hill, Newport, Mon., on or before 11 a.m., on Saturday, the 8th day of April, 1905.

The Board do not bind themselves to accept the lowest or any Tender.

Dated this 10th day of February, 1905.

T. S. EDWARDS,
Clerk to the Western Valleys (Mon.) Sewerage Board.

24, Stow Hill, Newport, Mon.

CLYDE NAVIGATION.—TO MECHANICAL AND ELECTRICAL ENGINEERS.

ELECTRIC POWER GENERATING AND LIGHTING PLANT.

The Trustees of the Clyde Navigation invite **TENDERS** for **ELECTRIC POWER GENERATING** and **LIGHTING PLANT** for Clydebank Dock.

Copies of the general specification, with form of Tender, are to be had at this office, from Mr. GEO. H. BAXTER, the Mechanical Engineer, on payment of £3 3s., which will be refunded on receipt of a *bonâ fide* Tender.

Sealed Tenders, marked "Tender for Electric Generating Plant," to be lodged with the undersigned not later than Monday, April 10th, 1905.

The Trustees may not accept the lowest or any Tender.

T. R. MACKENZIE,
General Manager and Secretary.

16, Robertson Street, Glasgow,
March 10th, 1905.

THE SECRETARY OF STATE FOR India in Council is prepared to receive TENDERS from such persons as may be willing to supply :—

1. BEARING PLATES FOR RAILS.
2. 152-ft. SPANS FOR ROAD BRIDGE.
3. BRASS BOILER TUBES.
4. COPPER FIREBOX PLATES.
5. WHEELS AND AXLES FOR CARRIAGES AND WAGONS.
6. SPRINGS, LAMINATED.
7. SPRINGS, SPIRAL AND VOLUTE.

The conditions of contract may be obtained on application to the Director-General of Stores, India Office, Whitehall, S.W., and Tenders are to be delivered at that office by Two o'clock p.m. on Tuesday, March 28th, 1905, for Nos. 1 to 5, and on Tuesday, the 4th April, 1905, for Nos. 6 and 7, after which times respectively no Tender will be received.

India Office, Whitehall,
March 15th, 1905.

E. GRANT BURLS,
Director-General of Stores.

VICTORIAN RAILWAYS. — TENDERS are invited for the MANUFACTURE, SUPPLY, and DELIVERY of STEEL RAILS and FISH-PLATES.

Tenders, accompanied by the preliminary deposit of £250, must be lodged in the Tender Box at the Railway Offices, Melbourne, Victoria, Australia, or at the office of the Agent-General for Victoria, 142, Queen Victoria Street, London, E.C., before 1 p.m., on Monday, April 10th, 1905.

Charge for specification with drawing, 7s. 6d.

COUNTY OF LONDON. — TO ELECTRICAL ENGINEERS, ETC.

THE LONDON COUNTY COUNCIL invites **TENERS** (a) for the **MANUFACTURE, DELIVERY,** and **ERECTION** of **EIGHT** 500-kw. **INDUCTION MOTOR-GENERATORS** for certain Sub-Stations in connection with the Council's Electric Tramways, and for the **SUPPLY** and **DELIVERY** at the Greenwich Electricity Generating Station of (b) **GENERAL WIRING MATERIAL** and (c) **LOW-TENSION CABLES, CABLE BOXES,** etc.

Persons desiring to submit Tenders may, on and after Monday, March 20th, 1905, inspect the Drawings and obtain Specifications, Bills of Quantities, Forms of Tender, and other particulars at the County Hall, Spring Gardens, S.W., upon payment to the Cashier of the Council of the sum of £2 for each Specification. This amount will, after the Council or its Committee shall have come to a decision upon the Tenders received, but not before, be returned to the Tenderer provided he shall have sent in a *bonâ fide* Tender and not have withdrawn the same, but in no case will the fee be returned unless a *bonâ fide* Tender is submitted. Full particulars of the Work may be obtained on application at the County Hall previously to the payment of the fee for the Specification, etc. Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with. The Contractors will be bound by the contract to pay to all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule. Each Tender is to be delivered at the County Hall in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Motor-Generators, Wiring Material, or Cables, etc.," as the case may be. No Tender will be received after 10 a.m. on Tuesday, April 4th, 1905. Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept any Tender which is not strictly in accordance with the Specification, or the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.

County Hall, Spring Gardens, S.W.,
March 17th, 1905.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

CONTRACTS.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the **COUNCIL** invite **TENDERS** for the **CARRYING OUT** of the **FOLLOWING WORKS** at their Sewage Pumping Station—viz. :—

CONTRACT No. 1.—For Supplying and Fixing Two Lancashire Boilers, 18 feet long by 6 feet 6 inches diameter.

CONTRACT No. 2.—For Supplying and Fixing Steam Pumping Engine and Pumps.

In connection with this Contract, persons tendering are required to submit detailed Drawings and Specifications of the type of Engine and Pumps they propose to supply.

CONTRACT No. 2A.—For Supplying and Fixing Gas Pumping Engine and Pumps, together with Suction Gas Plant complete.

Printed Specifications and Forms of Tender will be forwarded on application to the undersigned. Applications to be accompanied by a deposit of £2 2s. in each case, which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders, endorsed "Contract No. —" to be sent to me by 4 o'clock p.m. on Monday, the 8th day of May, 1905.

The Council do not bind themselves to accept any Tender.

By order,
THOS. SWATHERIDGE,
Clerk of the Council.

Council Offices, 7, North Street, Bishop's Stortford,
March 17th, 1905.

THE CONVOY WOOLLEN CO., LTD., CONVOY, co. Donegal, Ireland, are prepared to receive TENDERS for a 400 Horse-power TRIPLE-EXPANSION STEAM ENGINE and a 400 Horse-power STEAM BOILER.

The specifications, which have been prepared by the Consulting Engineer, Professor JAMES LYON, M.A. Dublin, can be obtained by application to the Company on payment of Two Pounds, which will be returned on receipt of a *bonâ fide* Tender.

The Company do not bind themselves to accept the lowest or any Tender.

Tenders for either or both must be deposited with the Company on or before April 7th.

PAGE'S WEEKLY Contracts

EAST INDIAN RAILWAY.—The East

Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of :—

(1) STEEL PLATES, ANGLES, BARS, etc. ;
(2) FILES ;
(3) PICKS, KODALIES, PHOWRAHS, and SHOVELS ;
(4) HAMMER HANDLES and MALLETS ;

as per specifications to be seen at the Company's Offices.

Tenders are to be sent to the undersigned, marked "Tender for Steel Plates, etc.," or as the case may be, not later than Twelve o'clock noon on Wednesday, the 5th day of April next.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

Fees, which cannot under any circumstances be returned, are charged, for the specifications as under, viz. : For Nos. 1 and 2, 21s. each, and for Nos. 3 and 4, 10s. 6d. each.

By order,
C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.,
March 23rd, 1905.

CLYDE NAVIGATION.—TO BOILER-MAKERS.

BOILERS AND SUPERHEATING APPARATUS.

The Trustees of the Clyde Navigation invite TENDERS for BOILERS and SUPERHEATING APPARATUS for Electric Power Generating Plant at Clydebank Dock.

Copies of the specification and form of Tender are to be had at this Office, from Mr. GEO. H. BAXTER, the Mechanical Engineer, on payment of £2 2s., which will be refunded on receipt of a *bona fide* Tender.

Sealed Tenders, marked "Tender for Boilers and Superheating Apparatus," to be lodged with the undersigned not later than noon on Monday, April 17th, 1905.

The Trustees may not accept the lowest or any Tender.

16, Robertson Street, Glasgow,
March 24th, 1905

T. R. MACKENZIE,
General Manager and Secretary.

CLYDE NAVIGATION.—TO SHIP-BUILDERS.

DREDGER.

The Trustees of the Clyde Navigation invite TENDERS for a BOW-WELL CENTRE-LADDER SELF-PROPELLING DREDGER.

Dawings may be seen, and copies of the specification and form of Tender obtained, on application at this office to Mr. GEO. H. BAXTER, the Mechanical Engineer, on payment of £5 5s., which will be refunded on receipt of a *bonâ fide* Tender.

Sealed Tenders, marked "Tender for Dredger," to be lodged with the undersigned not later than noon on Monday, April 17th, 1905.

The Trustees may not accept the lowest or any Tender.

16, Robertson Street, Glasgow,
March 22nd, 1905.

T. R. MACKENZIE,
General Manager and Secretary.

BOROUGH OF HAMMERSMITH.

ELECTRICITY DEPARTMENT.

The Hammersmith Borough Council invite TENDERS for the SUPPLY of the following :—

1. BOILER FLUES and ECONOMISERS.
2. HIGH-PRESSURE STEAM PIPES.
3. HIGH-PRESSURE FEED-WATER PIPES.
4. EXHAUST STEAM FEED-WATER HEATER and CIRCULATING WATER PIPES.
5. STEAM VALVES and FEED-WATER HEATERS, and
6. COAL ELEVATOR.

Specifications and Forms of Tender can be obtained of the Borough Electrical Engineer, Mr. G. GILBERT BELL, Electricity Works, 85, Fulham Palace Road, W., upon payment of One Guinea, which will be returned upon receipt of a *bonâ fide* Tender.

Sealed Tenders to be endorsed and delivered to me at the Town Hall, Broadway, Hammersmith, not later than 4 p.m. on Wednesday, April 5th, 1905.

The Council does not bind itself to accept the lowest or any Tender,

March 14th, 1905.

H. THOMPSON, Town Clerk.

BOROUGH OF BATLEY.—BRADFORD ROAD TRAMWAYS RECONSTRUCTION.

The Batley Corporation invite TENDERS for the following Works in connection with the Extension of the Tramways in Bradford Road :—

Contract No. 14.—PERMANENT WAY CONSTRUCTION and PAVING.

Contract No. 15.—OVERHEAD EQUIPMENT, STEEL POLES, etc.

Contract No. 16—FEEDER CABLES, CONDUITS, and ACCESSORIES.

Copies of the General Conditions, Specifications, Quantities, Form of Tender and Drawings may be obtained from Messrs. LACEY, SILLAR, AND LEIGH, 2, Queen Anne's Gate, Westminster, on and after the 29th inst., on payment of a deposit of £2 2s. in respect of each Contract, which will be returned on receipt of a *bona fide* Tender. Further copies of the Specification or Quantities can be obtained on payment of a further fee of Half-a-Guinea per copy, which will not be returned.

Tenders on the prescribed form, and endorsed "Tramways, Contract No. —," to be delivered at my office not later than April 17th proximo.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
JOS. HANSON CRAIK,
Town Clerk.

Town Clerk's Office, Batley,
March 21st, 1905.

CITY OF ABERDEEN.—ELECTRICITY DEPARTMENT.

Tenders are invited for the Supply of ONE SURFACE CONDENSER, with Air Pump, Oil Separator, etc.

Specification, with General Conditions of Contract and Form of Tender may be obtained from the undersigned on and after 29th inst. on payment of £2, which sum will be returned upon receipt of a *bona fide* Tender.

Offers, endorsed "Tenders for Condenser," and addressed to the Engineer, must be delivered at or before noon on Wednesday, April 19th.

Corporation Electricity Works,
Millburn Street, Aberdeen.

J. ALEX. BELL,
City Electrical Engineer.

ARBROATH CORPORATION WATER-WORKS.

CONTRACTS Nos. 4 AND 5.

The Corporation are prepared to receive TENDERS for the following WORKS, in connection with the Noran Water Scheme :—

Contract No. 4.—Supplying and Laying about 7½ miles of Cast Iron Water Pipes between Framsdrum and Colliston, and the Construction of a Service Reservoir at Framsdrum.

Contract No. 5.—Supplying and Laying about four miles of Cast Iron Water Pipes between Colliston and Arbroath, and the Construction of a Service Reservoir at Muirheads, near Colliston.

The plans may be seen, on and after Saturday, the 25th March, at the office of the Engineers, Messrs. CROUCH AND HOGG, C.E., 53, Bothwell Street, Glasgow, from whom copies of the specification, schedule of quantities, and form of Tender may be obtained on payment of Two Guineas for each contract, which will be returned to everyone sending in a *bonâ fide* Tender.

An Assistant Engineer will meet intending contractors at Arbroath Station on arrival of the train due at 10.45 a.m. on Tuesday, the 28th March, to show them over the route.

Sealed Tenders, marked outside "Tender for Arbroath Waterworks,' must be lodged with the undersigned, not later than 10 a.m. on Thursday, the 6th April.

The Corporation do not bind themselves to accept the lowest or any Tender.

W. K. MACDONALD,
Town Clerk Arbroath.

Arbroath, March 16th, 1905.

BOSTON UNION.—LAUNDRY FITTINGS, MACHINERY, ENGINE AND BOILER FOR NEW LAUNDRY AT THE WORKHOUSE, BOSTON.

The Guardians of the Poor of the Boston Union are prepared to receive TENDERS for LAUNDRY FITTINGS, MACHINERY, ENGINE and BOILER for the new Laundry proposed to be erected at the Workhouse, Boston.

Persons desirous of tendering for the above are to send in their names to the Architect, Mr. JAMES ROWELL, Church Lane, Boston, Lincolnshire, on or before March 25th, 1905.

Plans of the buildings and particulars of requirements may be inspected at the Architect's Office.

A copy of the plans of the buildings and requirements may, by arrangement with the Architect, be obtained on loan, on a deposit of £2, which sum will be returned on receipt of a *bonâ fide* Tender, &c., and the copy of plans and particulars, by time agreed.

Tenders, &c., to be sealed and endorsed "Tender for Laundry Machinery," and sent, addressed to the undersigned, not later than April 15th, 1905.

There is no undertaking to accept the lowest or any Tender, nor will any expenses be paid in connection therewith.

Clerk's Office,
28, Wide Bargate, Boston,
March 11th, 1905.

JOHN M. SIMPSON,
Clerk to the Guardians.

APPOINTMENTS OPEN.

INDIAN PUBLIC WORKS DEPARTMENT.

THE SECRETARY OF STATE FOR India in Council will, in the Summer of 1905, make not less than ELEVEN APPOINTMENTS of ASSISTANT ENGINEER in the permanent establishment of the Indian Public Works Department in addition to the appointments to be made from Coopers Hill College.

The age of candidates must not be less than 21, or more than 24, years on the 1st July, 1905.

A printed form of application, together with information regarding the conditions of the appointments and certain requirements laid down as to education and experience in engineering may be obtained from the Secretary Public Department, India Office, Whitehall, London, S.W.

The form of application is to be returned not later than Monday 1st May next.

A. GODLEY,
Under Secretary of State.

India Office,
February 24th, 1905.

STOREKEEPER. — Wanted, Situation in large Engineering Works, by thoroughly reliable and competent man; long experience, good stock and book-keeper; excellent references.—PROGRESSIVE, 28, Osborne Road, Sharrow, Sheffield.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23, and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T, D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N. 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

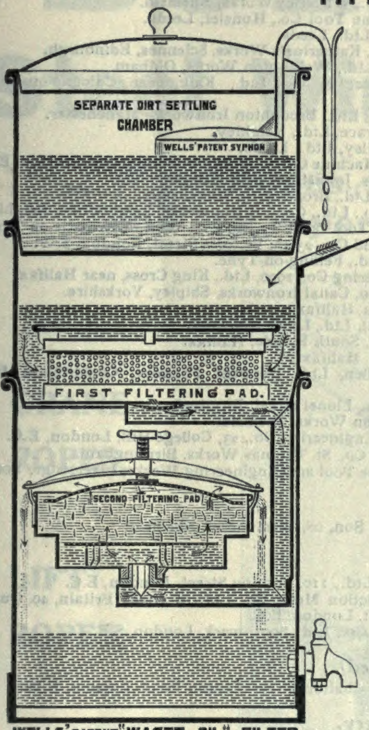
Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY Wells' Specialities

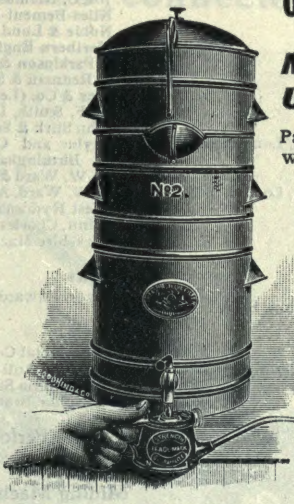
WELLS' PATENT "Waste Oil" FILTERS

FITTED WITH SIGHT-FEED SYPHON.



WELLS' PATENT "WASTE OIL" FILTER.

SUPPLIED TO THE PRINCIPAL GOVERNMENTS FOR THE NAVY, DOCKYARDS, &c., AND TO THE LEADING ELECTRIC LIGHT INSTALLATIONS, ENGINEERING WORKS, GAS ENGINE MAKERS, PRINTERS, &c., &c.



OVER *10,000* SOLD.

MONEY SAVERS to any USERS OF MACHINERY.

Pay first cost in a short time, as Dirtied Oil, which has hitherto been thrown away, can be filtered and used again and again.

Write for List of Testimonials and Samples of Work done by the Filter.

No. 1.	For users having only a small quantity of oil to treat (no syphon) 17 in. by 9 in.	35/-
No. 2.	Two top chambers hold about 3 gallons oil, 22 in. by 10 in.	50/-
No. 3.	Two top chambers hold about 6 gallons oil, 27 in. by 12 in.	70/-
No. 4.	Two top chambers hold about 12 gallons oil, 36 in. by 16 in.	110/-
No. 5.	Two top chambers hold about 24 gallons oil, 43 in. by 23 in.	189/-
No. 6.	Very powerful Filter for treating large quantities of oil, 54 in. by 30 in.	336/-

Capable of dealing with **250** Galls. Oil per week

LARGER SIZES MADE TO ORDER.

NO OUTSIDE POWER REQUIRED.

LIME, WHITING, OR COLD WATER PAINTS,

Applied at a speed of from 8 to 10 square yards per minute, in a manner superior to brush work.

One coat with the Machine on rough surfaces is equal to two applied with brushes.

Will save First Cost in a Few Days.

No. 6.	Handy Size. No Tank. On Wheels.	£7 7s.
No. 4.	Price, with 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose. Capacity 6 gals.	£8 10s.
No. 4A.	Price, with Wheels, 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose, **Same capacity as No. 4 Machine.**	£9 10s.
No. 5.	With 5-ft. Pole, Double Spraying Nozzle, and 20 ft. Special Armoured Hose, Large Size. Capacity 10 gals.	£10 10s.
No. 5A.	Ditto Ditto fitted with Wheels.	£11 15s.

WELLS' IMPROVED LIMEWASH.

MUCH SUPERIOR TO ORDINARY LIMEWASH. SLAKED WITH WATER. QUICKLY MIXED. WILL NOT RUB OFF. LEAVES A GOOD SURFACE.

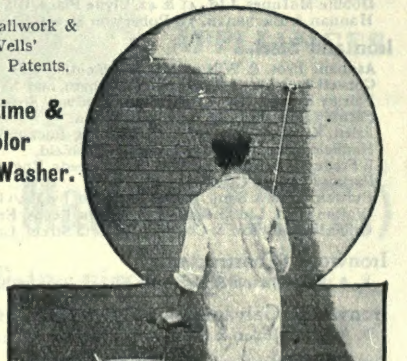
Price 13/8 per cwt., Carriage Paid in England and Wales, (If in lots of 3 cwt. at a time, 12/8 per cwt.)

A. C. WELLS & Co.,
100a, Midland Road, St. Pancras,
Works: Cheetham, Manchester. LONDON, N.W.

WELLS' "LIGHTNING"

Wallwork & Wells' Patents.

Lime & Color Washer.



No. 4a, with Wheels.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds. England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
John Stirk & Sons, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Winn, Charles. & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co., Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31. Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

BULLIVANTS'

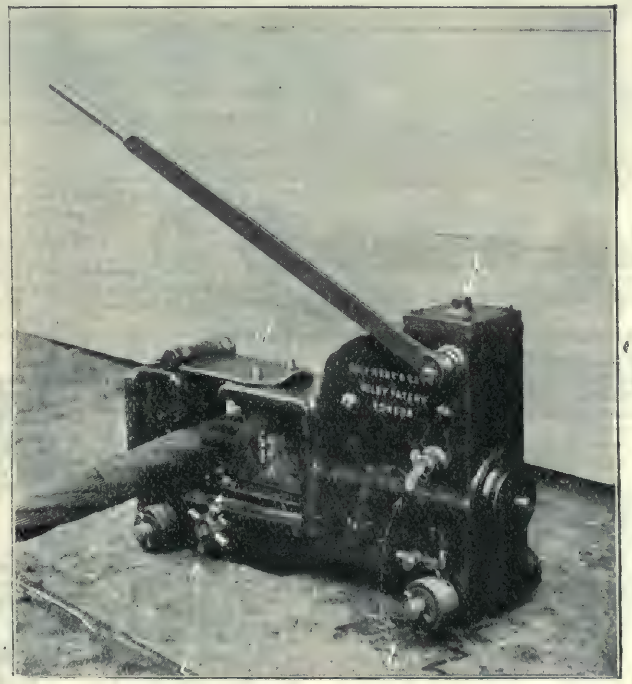
Steel Wire Mining Ropes.

Wire Ropes for Hauling and Winding Gear,
and all operations connected with Mining.

CRANE ROPES,

LIFT ROPES,

HAULING ROPES,



BLOCKS,

PULLEYS,

CRAB WINCHES,

AND ALL WIRE ROPE APPLIANCES.

Patent Hydraulic Rope-Cutting Machine (SELBY PATENT)

With this Machine a man can cut up to 9-in. circ. wire rope
without assistance in about one minute.

RAPID. SIMPLE. PORTABLE. LABOUR SAVING.

Prices and all Particulars on application to Sole Manufacturers :—

BULLIVANT & CO., Ltd., Works: MILLWALL, E.

Telephone No.: 239 EASTERN.

Buyers' Directory—(*Continued*).

Photo Copying Frames.
J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.
Booker & Sullivan, 67 and 69, Chancery London, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.
Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.
Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pipe Wrenches (Chain).
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.
Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.
Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.

Rails.
Wm. Firth, Ltd., Leeds.

Railway Wagons.
Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work
F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.
D. Anderson & Son, Ltd., Lagan Felt Works Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).
Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.
Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.
Williams, J. H. & Co., Brooklyn, New York, U.S.A.

Stampings.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).
Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner Birmingham.

Stamps (Metal).
Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.
British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.
Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.
Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Stokers.
Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.
S. Pegg & Son, Alexander Street, Leicester.

Superheaters.
A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.
Howard Bros., 10, St. George's Crescent, Liverpool, and 100c Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.
Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.
G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
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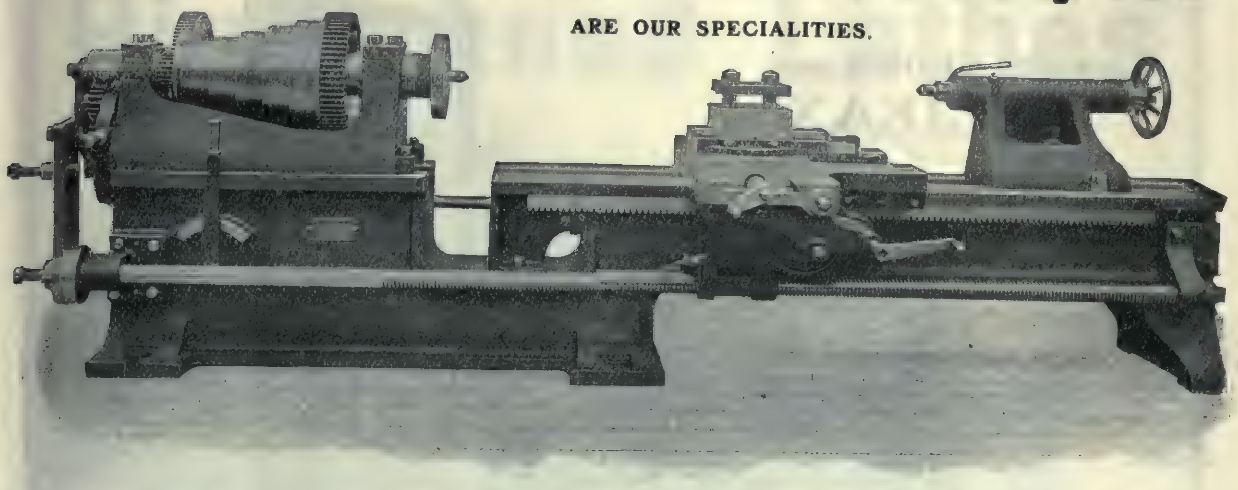

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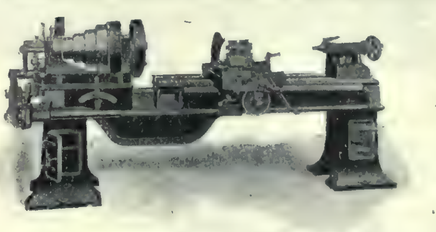

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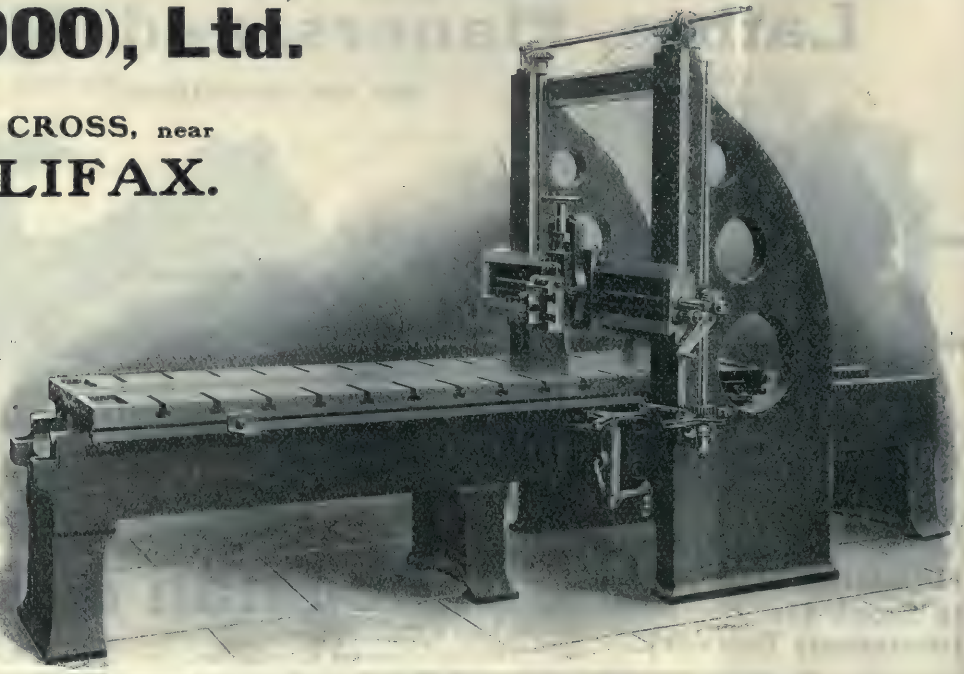

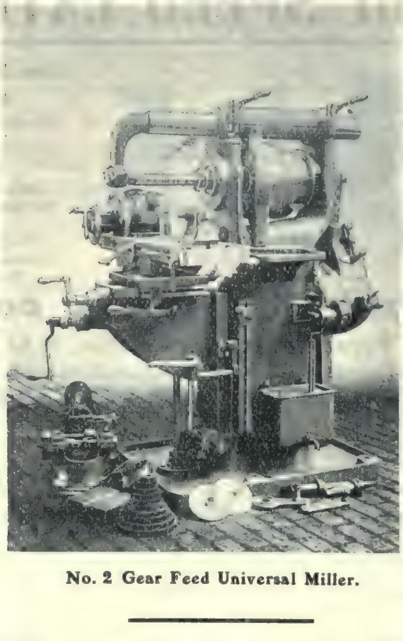

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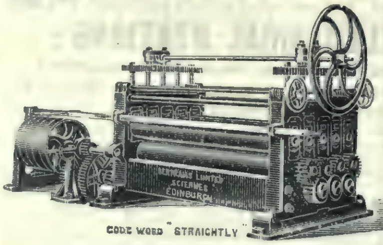

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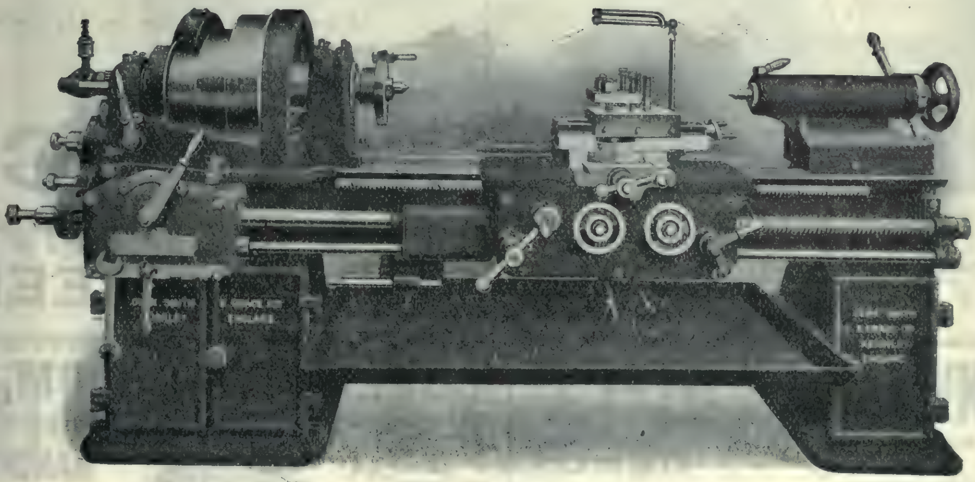

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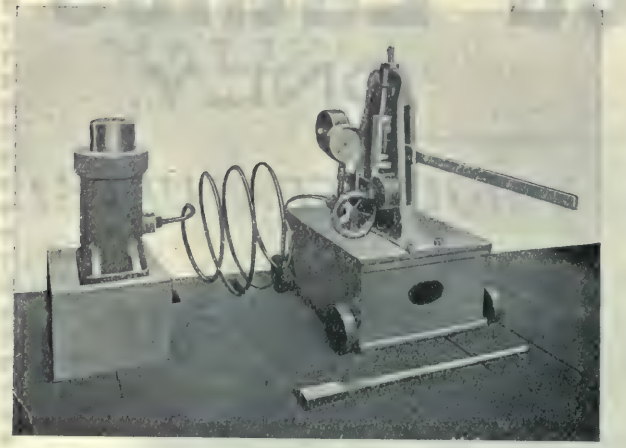

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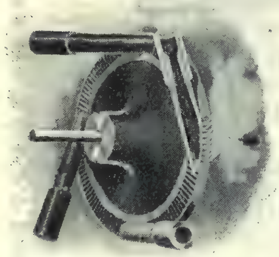

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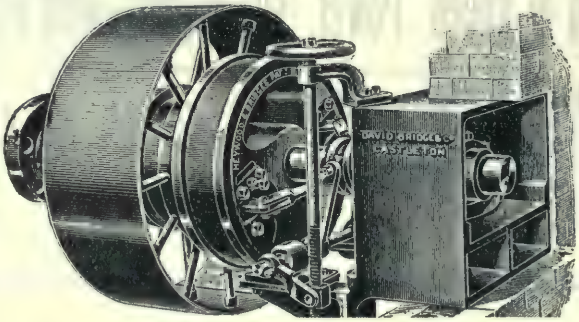

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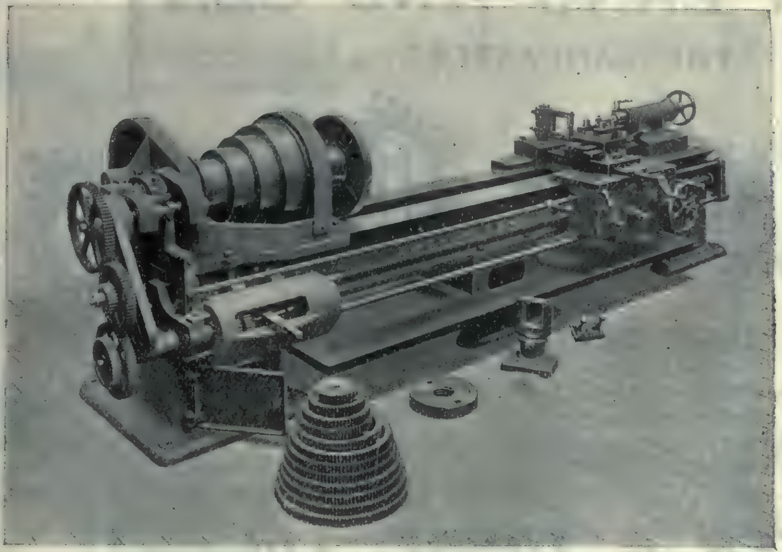

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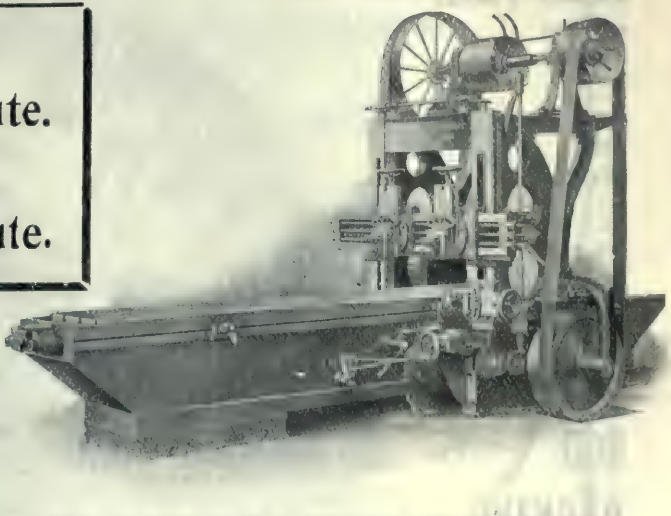

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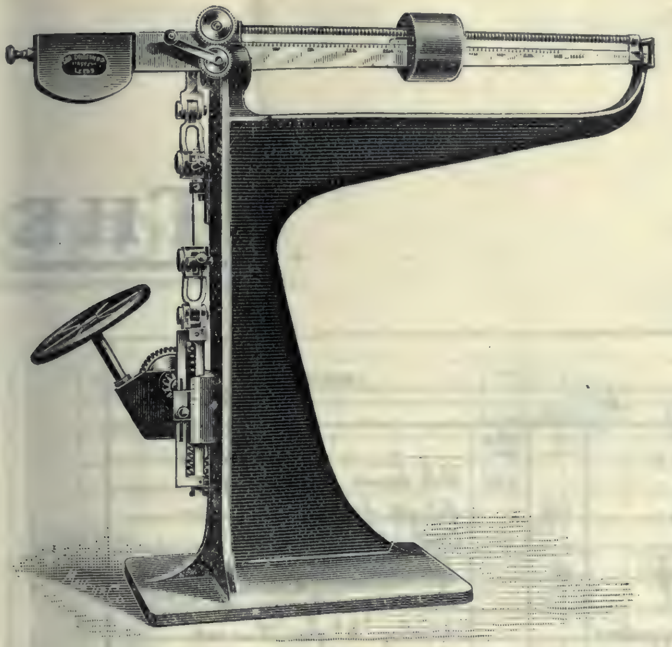

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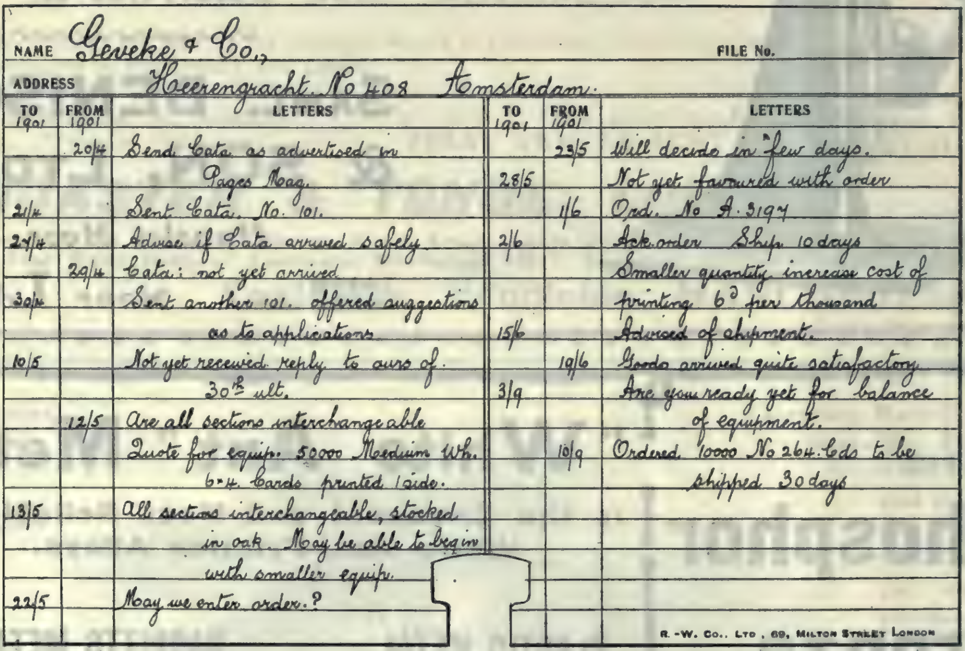

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		Pages Mag.	28/5		Not yet favoured with order
21/4		Sent Cata. No. 101.		1/6	Ord. No A. 3197
27/4		Advise if Cata arrived safely	2/6		Ack. order Ship 10 days
	29/4	Cata: not yet arrived			Smaller quantity increase cost of
30/4		Sent another 101. offered suggestions			printing 6^{d} per thousand
		as to applications	15/6		Advised of shipment.
10/5		Not yet received reply to ours of.		19/6	Goods arrived quite satisfactory
		30th ult.	3/9		Are you ready yet for balance
	12/5	Are all sections interchangeable			of equipment.
		Quote for equip. 50000 Medium Wh.		10/9	Ordered 10000 No 264. Cds to be
		6×4. Cards printed 1 side.			shipped 30 days
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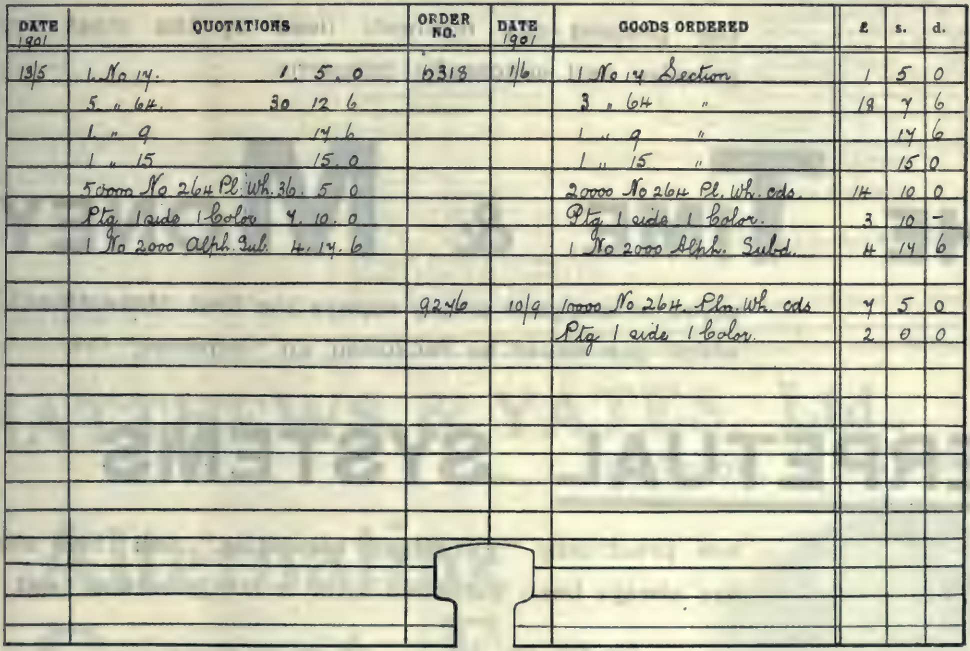

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Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

PAGE
Addy, George, & Co. ... —
Ahlers, Ad. ... —
Allgemeine Elektricitäts-Gesellschaft —
Allis-Chalmers Co. ... —
Anderson & Son, Ltd., D. ... —
Askham Bros. & Wilson, Ltd. ... —
Atlantic Press ... —
Avery, Ltd., W. & T. ... —

Babcock and Wilcox, Ltd. ... 3
Baldwin Locomotive Works ... 33
Barns & Son, W.... —
Bateman's Machine Tool Co. ... 17
Baynes, Charles ... Inside Front Cover
Beldam Packing and Rubber Co. ... —
Bennis & Co., Ltd., Ed. ... 31
Berry & Co., Ltd., Hy. ... —
Bertrams, Ltd. ... 14
Binney & Son ... —
Bleichert & Co., A. ... —
Blumann & Stern, Ltd.... 24
Bolton & Co., A. ... —
Booker & Sullivan ... —
Booth & Bros., Ltd., Joseph ... —
Bradbury & Co., Ltd. ... 5
Brand, Ed. ... 3
Brett's Patent Lifter Co., Ltd. ... 4
Breuer, Schumacher & Co. ... —
Bridge & Co., David ... 16
British Steam Specialties, Ltd. ... 44
Broadbent & Sons, Ltd., Thos. ... —
Broadbent, T. W. ... 44
Buckley, Samuel ... —
Bullivant & Co., Ltd. ... 11

Cambridge Scientific Instrument Co., Ltd. —
Campbell Gas Engine Co. ... —
Capell Fan Co. ... 44
Churchill & Co., Ltd., Charles ... —
Clarke's Crank & Forge Co., Ltd. ... —
Clayton, Son, & Co., Ltd. ... 32
Cochran & Co. (Annan) ... —
Concentric Condensers, Ltd. ... 41
Consett Iron Co., Ltd. ... —
Crosby Lockwood & Son ... —
Crypto Electrical Co. ... —
Cunliffe & Croom, Ltd. ... 16

Davidson & Co., Ltd. ... 36
Davis & Primrose ... 3
Dean, Smith & Grace, Ltd. ... 15
Deighton's Patent Flue & Tube Co., Ltd. —
Delange & Cie, Mc. ... —
Delta Metal Co. Ltd. ... Outside Back Cover
Denison, S., & Son ... 19
Dobbie-McInnes, Ltd ... 3
Drum Engineering Co. ... 44

Eclipse Tool Manufacturing Co. ... —
Elliott & Fry ... 33
Elliott-Fisher Co. ... —
Empire Typewriter Co.... —
Engine Builders ... —
Enke, Carl... —

Fairbanks Co. ... 26
Fairbanks, Morse & Co. ... —
Fairley & Sons, James ... Outside Back Cover
Farnley Iron Co., Ltd. ... —
Firth, Ltd., William ... —
Fleming, Birkby & Goodall, Ltd. ... —
Fowler, John, & Co. (Leeds), Ltd. ... —
Fraser & Chalmers, Ltd. ... —
Frictionless Engine Packing Co., Ltd. —

Garrett & Sons, Ltd., R. ... —
Gent & Co., Ltd.... —
Gibbs, J., & Son ... 5
Gilkes & Co., Ltd., G. ... —
Gilmour, W. & O. ... 32
Glover & Co., M. ... 4
Graham, Morton & Co., Ltd.... 3
Grantham Crank & Iron Co., Ltd. 25
Green & Son, Ltd., E. ... Inside Back Cover
Greenwood & Batley, Ltd. ... 16
Griffin & Co., Ltd., Charles ... 13

Hadfield's Steel Foundry Co., Ltd. ... —
Hagan's Locomotive Works ... —
Halden & Co., J. ... —
Hall & Co., B. J. ... —
Hall & Sons, Ltd., J. P. ... 40
Hamilton & Co., J. B. ... 3
Hannan & Buchanan ... —
Hardy Patent Pick Co. ... —
Hartley & Sugden, Ltd. ... 4
Hasenclever Söhne, C. W. ... —
Hathorn, Davey & Co., Ltd. ... —
Head, Wrightson & Co., Ltd.... 4
Heenan & Froude ... 5
Holmes & Co., W. C. ... —
Horsfall Destructor Co. ... 32
Howard Bros. ... 43
Howes Co., S. ... 39
Hudswell, Clarke & Co., Ltd. Inside Front Cover
Hughes & Lancaster ... 4
Hughes, G. H. ... 3
Hunslet Engine Co. ... —

India Rubber, Gutta Percha, and Telegraph Works Co., Ltd. ... —

Jones & Lamson Machine Co. ... 5

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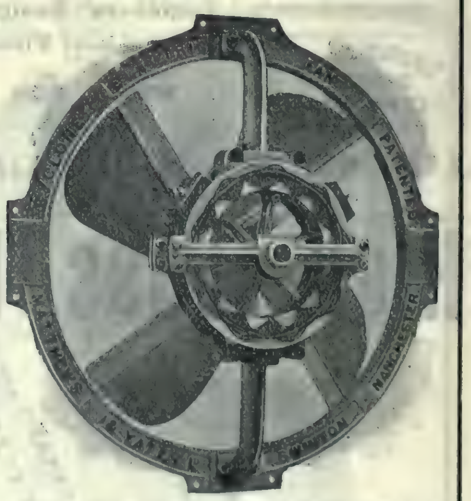

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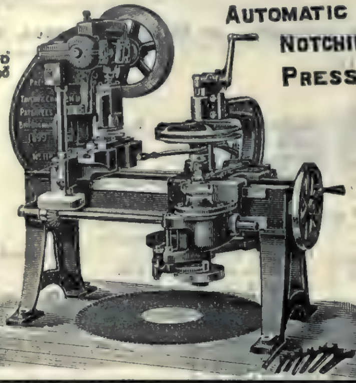

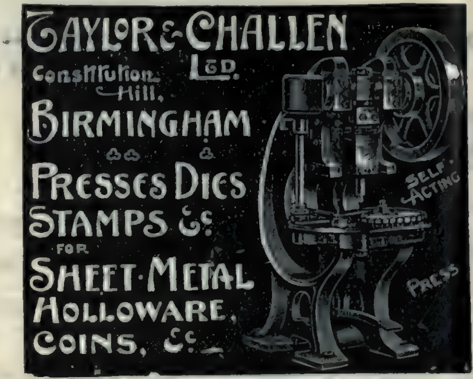
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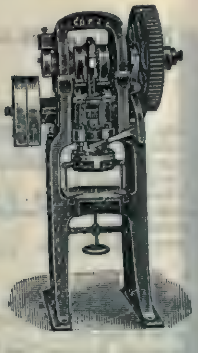
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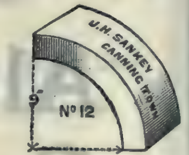

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Index to Advertisers—(Contd.)

PAGE
Keep, F. A., Juxon & Co. 40
Keith, J., & Blackman Co., Ltd. ... —
Krupp, Fried. 24

Lancaster & Tonge, Ltd. 18
Lang & Sons, John 4
Lassen & Hjort ... ... —
Leckenby, Benton & Co. 13
Leeds Forge Co., Ltd. ... ... —
Lepard & Smiths, Ltd. ... ... —
Luke & Spencer, Ltd. ... ... —
Lyle Co., Ltd. 42

Mabie, Todd & Bard 26
McLaren, J. & H. 33
Magnesia Coverings, Ltd. ... ... —
Magnolia Anti-Friction Metal Co., Ltd. —
Marion & Co., Ltd. ... ... —
Mason, Ltd., W. F. ... ... —
Mather & Platt, Ltd. 37
Matthews & Yates, Ltd. 23
Meldrum Bros., Ltd. 30
Melling, J. F. ... ... —
Melville and Macalpine ... ... —
Metallic Paint Co., Ltd. 44
Miller & Co., Hy. ... ... —
Mirrlees-Watson Co., Ltd. 29
Mitchell, D., & Co., Ltd. 39
Mix & Genest ... ... —

Nalder Bros., & Thompson ... ... —
New Anglo-American Machine Brush Syn. —
New Zealand Mines Record ... ... —
Newton Bros. 14
Nicholson Tool Co., Jos. C. ... ... —
Niles-Bement-Pond Co. ... ... —
Noble & Lund, Ltd. 17
Northern Engineering Co. (1900), Ltd. 14
Northern Railway of France... ... —
Nye, Arthur W. ... ... —

Page & Rowlingson 3
Parker Foundry Co. ... ... —
Parkinson & Son, J. 14
Partridge & Cooper, Ltd. ... ... —
Pegg & Son, S. 35
Periam, Ltd., H. W. 34
Phœnix Dynamo Mfg. Co., Ltd. ... 4

PAGE
Phosphor Bronze Co., Ltd., ... 19
Piggott & Co., Ltd., Thos. ... ... —
Positive Rotary Pumps, Ltd.... ... 41
Power-Gas Corporation, Ltd. Outside Back Cover
Pratt & Whitney Co. ... ... —
Premier Boiler Tubes, Ltd. ... ... —
Pryor & Son, Edward 4
Purden & Sons, John ... ... —

Quaker City Rubber Co. 18

Recorders, Ltd. 5
Redfern & Co., S. ... ... —
Redman & Sons, C. 13
Reid Gear Co. ... ... Inside Front Cover
Reliance Lubricating Oil Co. ... ... —
Renshaw & Co., Ltd., W. R. 34
Rice & Co. (Leeds), Ltd. 16
Richardsons, Westgarth & Co., Ltd. —
Richter, Gustav ... ... —
Riter Conley Manufacturing Co. ... —
Robinson & Co., Ltd., T. D. ... ... —
Rockwell-Wabash Co., Ltd. ... ... 20 & 21
Roller, A. ... ... —
Rose, Downs & Thompson, Ltd. ... 5
Rossendale Belting Co., Ltd. ... ... —
Rubber Stamp Co. 40
Ryder, Ltd., William ... ... —

St. Helen's Cable Co., Ltd. ... ... —
Samson & Co. ... ... —
Sankey & Son, J. H. 24
Schieren & Co., Chas. A. ... ... —
Schnicke, H. F. 4
Scotch and Irish Oxygen Co., Ltd. ... 3
Scott, Walter, Ltd. 4
Shannon, Ltd. 42
Shaw, Joseph 5
Simplex Steel Conduit Co., Ltd. ... —
Smith, Eric, S. A. 3
Smith, Ltd., G. F. 13
Smith & Sons, of Saltley, Ltd., Thomas —
Soest & Co., Ltd., L. 28
South-Eastern & Chatham Ry. ... —
Southwood, Smith & Co., Ltd. ... —
Spon, E. & F. N. .. .. —
Spottiswoode & Co., Ltd. ... ... —
Stafford, Arthur, & Co. 3
Stamm, W. 24

PAGE
Stirk & Sons, John ... ... —
Sturtevant Engineering Co., Ltd. ... 27
Süddeutsche Kabelwerke, A.-G. ... —
Summerscales & Sons, Ltd., W. ... 39
Swain & Son, Ltd., John 33

Tangyes, Ltd. ... ... —
Taylor & Challen, Ltd. 24
Temperley Transporter Co. 3
Thom, John Z. 38
Thompson & Co., Gilbert 35
Thompson, John ... ... —
Thornycroft & Co., Ltd., John I. .. —
Titan Binder Co.... ... ... —
Trading and Manufacturing Co., Ltd. 22
Treasure & Co., J. B. ... ... —
Tubes, Ltd. ... ... —
Turner, Atherton & Co. 36

United States Metallic Packing Co., Ltd. —

Von der Heyde, J. Bennett ... ... —

Ward & Co., H. W. ... ... —
Ward, T. W. 5
Waygood & Co., Ltd. 3
Weaver & Co., B. ... ... —
Weise & Monski... ... ... —
Wells & Co., A. C. 9
Wells & Co., M. ... ... —
West & Co., Ltd., H. J. 27
West Hydraulic Engineering Co. ... —
West Pascagoula Creosoting Works —
Wild, M. B., & Co. 39
Williams & Co., J. H. 4
Winn & Co., Charles ... ... —
"Woodite" Co. ... ... —
Wrigley & Co., Ltd., E. G. Inside Front Cover

Yorkshire Patent Steam Wagon Co. 33
Yorkshire Machine Tool and Engineering Works ... ... Inside Back Cover
Yost Typewriter Co., Ltd. ... ... —

Zeitz & Co. 4

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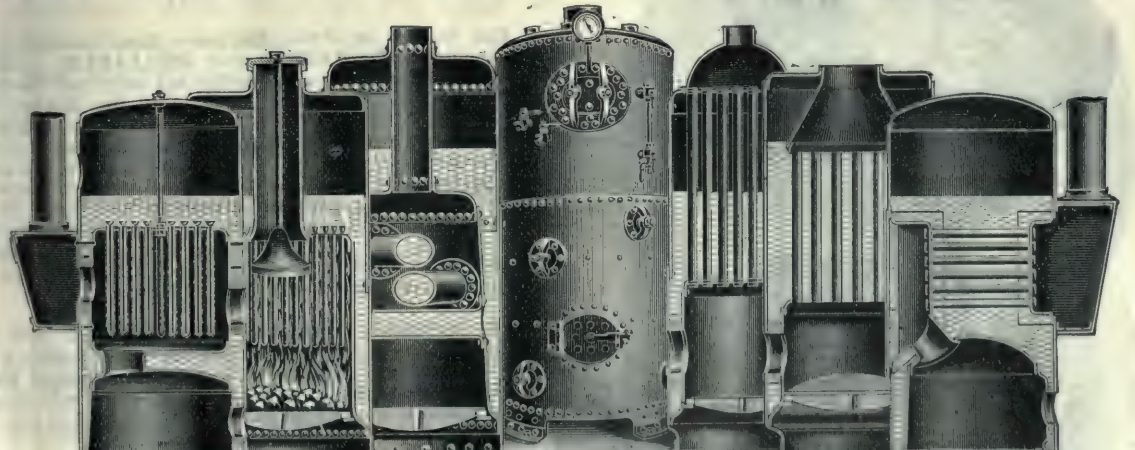

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PAGE'S WEEKLY Miscellaneous

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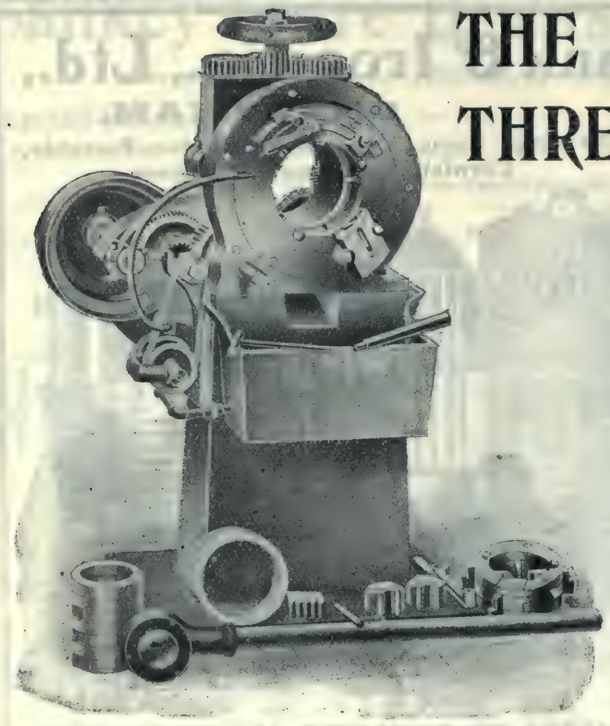
THE MERRELL TUBE THREADING MACHINES.



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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VI. LONDON, FRIDAY, MARCH 31, 1905. No. 29.

The Offices of "Page's Weekly," Wednesday Evening.

PROFESSOR J. T. NICOLSON has been having a very plain talk in the Manchester Guardian on the subject of training engineers, and it must be admitted that he makes out a very good case for a preliminary training in the workshop. At present a boy intending to become an engineer generally goes to college immediately upon leaving school, his workshop experience being relegated to a later period. "This is so," says Professor Nicolson, "not because it has been found to be the best way of training the boy, but because it is the only course open to him under present conditions. After three or four years of apprenticeship he finds it difficult, if not impossible, in the majority of cases to stop work and take a college course."

Professor Nicolson proceeds to remark that when a youth at the age of 18 or 19 leaves the technical school or engineering college, having completed his theoretical training, he possesses very often a considerable knowledge of the properties of the materials of engineering, of the theory of heat engines and hydraulics, of the theory of machines and structures, and of machine design. He can draw. He can test a specimen and take an indicator card, and he even knows what measurements must be made in testing an engine or boiler. But he is unable to make much practical use of his scientific knowledge, either because he finds it is not immediately necessary, or because, having had no experience of practical engineering work, he has no confidence in applying it to a concrete problem. When put face to face on his own responsibility with the simplest mechanical question he is found to be hopelessly at sea. He cannot do himself justice. He does not know which formula to use nor how far it is applicable. So it comes about that

Photo Elliott and Fry]

PROFESSOR SILVANUS P. THOMPSON, F.R.S.

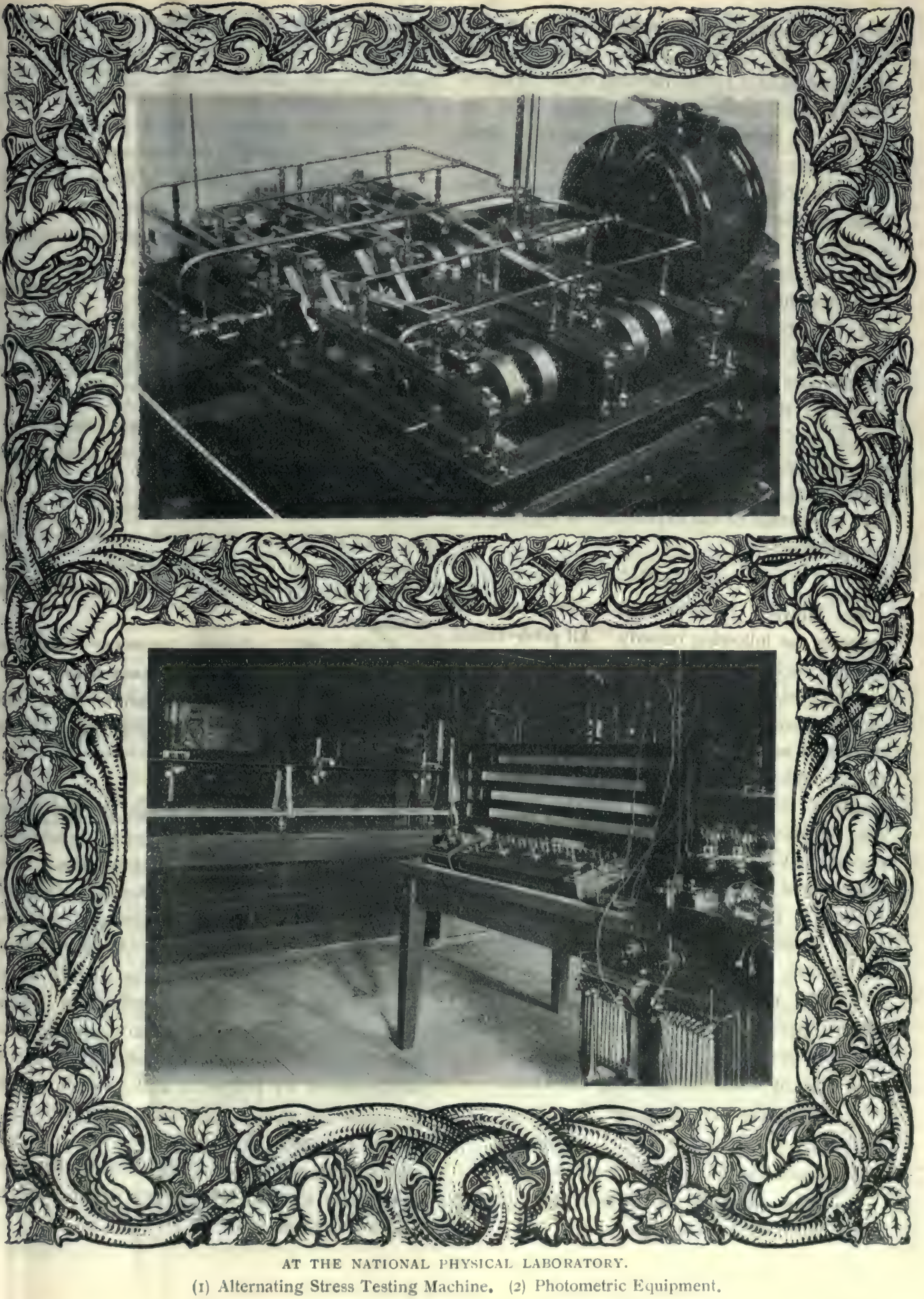
the employer looks with indifference upon a system of technical education which he plainly sees to be unproductive. The graduate of the engineering college or the diplomé of the polytechnic who has not been in the works is found to be of but little more value to an employer than a boy of the same age who has just left school.

In many cases continues the Professor, the pupils of our engineering colleges and technical schools acquire under existing methods a very small proportion of even the theoretical knowledge which it may have been attempted to impart. Their interest in the subject has not been aroused by preliminary observation in the workshops of the objects to be studied, and we do not find in them that keen desire to understand the principle of an appliance or the theory of a process which is manifested by those who have had to work them. Their studies appear to them a mere continuation of school work, and from long continuance too often become a weariness. Hence the cry for the lectures to be "made more interesting," and the cause of the absurd pop-gun element which so often makes its appearance on the lecture table.

Professor Nicolson will doubtless find many supporters when he proceeds to say that as a matter of fact the average youth from 16 to 19 years of age must be kept under discipline. He cannot be trusted to maintain a steady application to work if left alone. When following a course of study at this age he only learns as much of applied science or practical manipulation as the vigilance of the teacher or the system of checks to idleness compel him to do, so that any attempt to take up difficult because really useful work is a waste of time. If, on the other hand, he spends his time from 16 to 19 in the workshop he is much better employed. He is bound to work, whether he wishes to or not. He learns the elements of his profession by direct observation of practical methods and the actual handling of tools and machines, instead of having to picture them to himself from long descriptions and painful sketches. Professor Nicolson's experience is that, almost without exception, engineering students who have previously passed through practice become, at the end of their college course, men of the very highest industrial value.

It cannot surely be generally known, says Professor Nicolson in conclusion, that except by strenuous personal exertion, it is at present impossible to obtain this sequence of training, a sequence which is the only proper and sensible one. The employer, the educational authorities, and frequently even the teachers themselves all conspire to straiten the way leading to post-apprenticeship study. Employers naturally prefer men of 19 or 20 working in their shops for apprentices' wages to raw boys from school. The educational authorities know that if they do not get their pupil when he leaves school he will escape them altogether, and as, unfortunately, the teacher himself has often never been a practitioner and feels upon surer ground in dealing with ignorant schoolboys than with young men well versed in practical work, he also gives his vote in favour of the present system. Thus from a policy of expediency on the one hand and of self-interest or apathy on the other, our nonsensical system of "technical education" has grown up and now flourishes.

Mr. Swinburne has in a very interesting way shown the tendency of the business man in an engineering concern, to come out at the top, leaving the practical engineer in the middle and the pure scientist at the bottom. The commercial aspect of engineering is certainly a matter of very considerable importance, and therefore it may not be unprofitable to consider for a few moments the



AT THE NATIONAL PHYSICAL LABORATORY.
(1) Alternating Stress Testing Machine. (2) Photometric Equipment.

views held by our American friends on this subject. Mr. Charles A. S. Howlett raised the question at a recent meeting of the Western Society of Engineers and we have read his paper with interest, except the portion which lapses into psychology. This possibly is a pet subject of the author and may have crept in like King Charles's head, though how a study of the dual nature of the mind is to help one to sell say, planing machines, is not at first sight apparent. However, Mr. Howlett can be practical and accordingly he asks: Would not our engineering school training be much more complete and a great deal more beneficial if it embraced studies that would give us the benefit of the successful commercial side of the profession, as well as the purely engineering? Why cannot we be taught to take advantage of the experience of the successful salesman?

Mr. Howlett believes that we can and he suggests the following remedy: All professional schools, such as technical, medical, law, dental, agricultural, mining, pharmacy and the like, should incorporate in their senior year such studies as would develop the mind in a manner that would inspire in the student commercial instincts that would help him to profit by the experience of others in securing an opportunity to perform the work that his professional training enabled him to handle. In lieu of text books, lectures could be given in the senior year, on the following suggestions for topics:

1. "On the essentials to be kept in mind when approaching a stranger for a purely business interview."

2. "Many ways of securing attention."

3. "Arousing an interest in your proposition."

4. "Securing material for a persuasive talk."

5. "The elements of talking convincingly with logical expression."

6. "When to talk suggestively rather than argumentatively."

7. "On the elements of a successful impromptu address before an assemblage, such as a Municipal Council or State Board."

8. "On arguing a point successfully."

9. "On the admission of an interruption or an objection."

10. "The treatment and overcoming of self-assertion."

11. "The proper method of criticising competitor's arguments."

12. "Proper manner to assume in addressing the essentially serious and also the easy-going, pleasure-loving type."

13. "How to successfully create desire."

14. "Auto suggestion; its commercial possibilities."

15. Choosing the most successful time for an interview and the consideration of the proper time to discuss the matter of terms."

16. Points to be avoided in closing a business arrangement."

17. On the relation between character building and business-getting persuasion."

18. The influence of suggestion upon the human mind, with special reference to its commercial possibilities."

We commend these headings to Mr. Swinburne's attention. No. 18 seems to recommend a knowledge of hypnotism and we fancy that it might be safer to rely upon No. 4; otherwise there might be decided difficulties in the way of negotiations under No. 15. At the University of Illinois an endeavour is already being made to give practical suggestions in proper salesmanship. Specifications are prepared in the class-rooms and students asked to meet the requirements by proposals and to stand ready to argue for their apparatus, a particular type being assigned to each. The students are also encouraged to write the manufacturers for descriptive matter, stating exactly the use to which it is to be put.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.
Telephone No: 3349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Subscription Rates per Year.

Post free to any part of the world—In advance, 20s. for twelve months.

Sample Copies: United Kingdom, 6d., post free; Abroad, 8½d. post free.

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New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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MEETINGS FOR THE ENSUING WEEK.

FRIDAY, MARCH 31.—Royal Institution, Albemarle Street, W., 9 p.m.: Prof. Joseph Wright, "The Scientific Study of Dialects."—Mechanical Engineers, Storey's Gate, Westminster, S.W., 8 p.m,: Prof. David S. Capper, "First Report to the Steam Engine Research Committee" Discussion.

SATURDAY, APRIL 1.—Royal Institution, Albemarle Street, W., 3 p.m.: Lord Rayleigh, "Some Controverted Questions of Optics." (Lecture I.).—Birmingham Association of Mechanical Engineers, —Glasgow Technical College Scientific Society: Annual General Meeting.

MONDAY, APRIL 3.—Society of Engineers: Paper, "Statistics of British and American Rolling Stock," Mr. A. Pollard Digby, —Society of Arts: Cantor Lecture, "Telephony," Mr. H. Laws Webb.—Institute of Marine Engineers, Stratford. 8 p.m.

TUESDAY, APRIL 4.—Institution of Civil Engineers, 8 p.m.

WEDNESDAY, APRIL 5.—Society of Arts: Ordinary Meeting, 8 p.m.—Liverpool University Engieering Society; Paper, "Sewerage and Sewage disposal: Mr. A. S. Mason.—Geological Society of London.

THURSDAY, APRIL 6.—Chemical Society, 8.30 p.m.—Royal Institution, 5 p.m—Civil and Mechanical Engineers, Caxton Hall, S.W., 8 p.m.—Institution of Electrical Engineers, 8 p.m.

FRIDAY, APRIL 7.—Royal Institution: "American Industry": Mr. Jas. Moseley.

NEWS ITEMS.

A communication of considerable importance on the 1905 Patent Rules appears on page 681.

The new Royal yacht, to succeed the *Osborne*, is to be built by Messrs. Inglis of Glasgow. She is to be 285 ft. in length, 40 ft. in breadth, and of 2,000 tons gross, and will be fitted with turbine machinery giving a speed of 17 knots.

Messrs. Howard Bros. have found it necessary to remove to larger premises at 40, Paradise Street, Liverpool. The London headquarters of the "Dey" Time Registers are at 100c, Queen Victoria Street, E.C.

Dr. J. S. Owens. B.A., M.Inst.C.E., F.R.G.S., and Mr. Gerald O. Case, son of the late Mr. Edward Case, inventor of the Case system of foreshore protection, have opened a new office at 15, Tothill Street, Westminster, S.W., where they are practising as sea defence engineers.

The Yost typewriter has been awarded the gold medal at the Capetown International Exhibition. This excellent machine has now a record of twenty-three gold medals standing to its credit.

It is announced that Mr. George Whale, the chief mechanical engineer of the L. and N.W.R., and other officials will visit America next week to attend the railway congress and inspect the great railroads of the States, with a view to seeing if there are improvements which can with advantage be adopted here. An article on American locomotive construction will be found on page 696.

CONTENTS.

PAGE
Editorial Notes 669
Criticisms on Technical Education 669
Commercial Aspect of Engineering 670
National Physical Laboratory 671
News Items 673
Vauxhall Ironworks Company — New Premises (*Illustrated*) 674
Electrical Exhibitions 675
New Forging and Welding Machine (*Illustrated*) 676
Dover-Calais Train Ferry ... 676
A Pertinaceous Current 677
Motor Notes 678
1905 Patent Rules—Important Memorial 681
Naval Notes 685
High-Speed Railways (*Illustrated*) 686
Blast Furnace Recovery Plant 688
A New Horizontal Milling Machine (*Illustrated*) 692

PAGE
Our Weekly Biography—Sir William Crookes, F.R.S. D.Sc. (*Portrait*) 694
Shipbuilding Notes 695, 702
American Locomotive Construction 696
Duff Patent Twin Gas Producers (*Illustrated*) 698
Temperature Experiments on Field Coils of Electrical Machines 699
Civil Engineering 703
Manufactures of Greater Britain 704
Technical Society Notes 706
London Electric Power Bill 707
Contractors' News 709
Share List 711
Home Metal Market (*Chart*) 714
Prices Current 715
Patents, Selected (*Illustrated*) 720
Publications 722
Catalogues 722
Meetings for the Ensuing Week 673

MAIN MARINE ERECTING BAY IN THE NEW WORKS OF THE VAUXHALL IRONWORKS COMPANY, LTD., AT LUTON.

ONE OF THE MOTOR BAYS.

The Vauxhall Ironworks Company, Ltd.—Opening of New Works.

In company with a large party of invited guests a representative of PAGE'S WEEKLY journeyed to Luton on Wednesday to be present at the opening of new works by the above company. The visit proved to be both interesting and instructive, and the guests were most hospitably entertained.

The new works are situated on the Midland main line, with a siding into the works at Luton, upon 6½ acres freehold. The present shops comprise four bays, each of 35 feet span, and are served throughout their length with overhead travellers, the main bay being 24 ft. to the underside of the crane from floor level.

The overhead travellers range from one ton to 12 tons, but provision has been made for serving the main marine erecting bay with a 20-ton traveller when required. Two bays are occupied by the old-established marine department of the business, and the machinery, etc., is ample for dealing with engines up to 1,000 horse-power. The main two bays are devoted to the more recent, but rapidly extending, motor work of the company.

A quantity of new plant has been installed, including a powerful "Massey" electrically-driven power hammer, gear-cutting machines, automatic turret machinery, etc.

Commodious offices, built in brick throughout, are placed across the end of the four bays, and comprise a large general office, drawing office, board room, a number of small offices, and lavatories. There is a gallery which gives a complete view over all the shops. A separate building, 90 ft. by 40 ft. span, is just being commenced to form the motor garage and testing department. A building is to be also shortly erected for the wood-work in connection with car bodies, upholstering and painting shop. The company has built a handsome house for the manager, two foremen's houses, caretaker's house, and a row of superior workmen's houses.

The whole of the machinery is driven by electric motors. Seven motors have been installed, driving line shafting, and in two instances independent motors have been provided for driving two large machine tools as independent units. The offices are lighted and heated throughout by electricity, the works being brilliantly illuminated with Lucas gas lights. A mess room, with gas cooker, has been provided for the use of the workmen.

The accompanying illustrations show the main marine erecting bay and one of the motor bays in the new works.

Holborn Electricity Exhibition.

The Holborn and Finsbury Electrical Exhibition is proving a great success. The daily attendance has been very good, and it is clear that the enterprise of the County of London Electric Supply Company in providing the exhibition is being properly recognised. The advantage of using electrical power is perhaps not so well appreciated as it should be, and the exhibition provides an object lesson of what this particular London supply company is doing, and is prepared to do, in bringing about the wider application of electrical energy for power purposes. One of the most interesting features of the exhibition is the sub-station which the County of London Company has put up for supplying the necessary light and power to the exhibition, and a representative of PAGE'S WEEKLY was assured by Mr. T. W. Cole, who represents the promoting Company, that every possible contingency had been provided for, as regards current. Further attention will be paid to some of the exhibits in our next issue. The exhibition closes on the 5th prox.

Paddington Electricity Exhibition.

This exhibition has been organised by the Metropolitan Electric Supply Company, and its purpose, like that of the similar exhibition now open in Holborn, is to direct public attention, especially the attention of residents in the borough of Paddington, where that Company has the statutory supply of electricity in its hands, to modern developments of electricity for lighting, heating, ventilating, and power purposes. Electric lamps, shades, brackets, and other domestic fittings naturally take up a large proportion of the space on the forty stands, but many other applications of electricity also receive due attention. There is a good show of electrical heating and cooking appliances and of electrical radiators, whether for use in ordinary rooms or for medical purposes, while motors are to be seen attached to machines of all sorts, from chaff-cutters and horse clippers to organ-blowers and knife-cleaners. Mention may also be made of several varieties of electrical advertising signs, and of electrical pianos, which supplement the efforts of the Grenadier Guards band to provide music for visitors to the exhibition. Among more purely engineering exhibits there is a gravity bucket conveyer for coal, etc., with models of a water-tube boiler and mechanical stoker, and a magnetic separator for separating iron and steel from other materials.

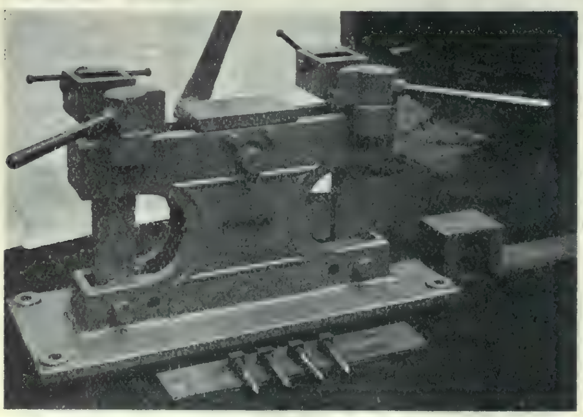
We understand that the projected second International Wireless Telegraph Conference will not take place during the present year.

An Accessory for the Smith's Shop.

The accompanying illustration gives a fair idea of a machine which is worked by hand in blacksmiths' shops for expeditiously welding iron and steel bars and shafts of various sections up to a diameter of 6 in. A description of the operation will, no doubt, interest those engaged in blacksmiths' work, and others who have to superintend same.

The machine is securely fixed to the ground near to the hearth on which the bars are heated. The two parts to be welded are first placed cold on the machine and the vices arranged so that the ends of the bar come exactly opposite each other, as seen in illustration. The bars are then heated to a short welding head and being quickly brought on to the machine, are gripped by turning the cams. The lever being immediately brought down, the ends of the bars are squeezed into each other. This slightly increases the diameter at the point which should be hammered down on the machine, the pressure being maintained during the process, and until all indication of the weld is obliterated. The welded bar is then removed to the anvil or steam hammer, and finished by the use of swages. It will be seen that this process saves the necessity for any "scarfing," or other preparation before the bar is heated, and a better job is secured than is possible by any other method.

The machine is also effective for welding up collars and bosses in iron bars, the pressure on the bar with one man at lever being equal to twenty tons. By reversing the machine it can be employed in drawing out or elongating the heated bar, and the great power which can be brought into operation enables the blacksmith to do a variety of work which otherwise would not be possible. The manufacturers are the Messrs. Joseph C. Nicholson Tool Co., of Newcastle-on-Tyne.



"STANDARD" WELDING AND FORGING MACHINE.

Dover-Calais Train Ferry.

The proposal to connect Dover and Calais by a train ferry is, as many of our readers will remember, by no means a new one. Sir John Fowler's scheme, which was before Parliament in 1870 and 1872, was rejected twice by the House of Lords, but we are not aware that any logical objections were urged against the scheme *per se*. Since then the utility of train ferries has been demonstrated in many parts of the world, and their advantages should appeal, not only to passengers whose business it is to cross the "Sleeve" in the quickest possible time, but also to manufacturers shipping goods. According to the Times, the scheme now before Parliament, which is backed on the Continent by Messrs. Schnieder, of Creusot, the Compagnie de Fives-Lille, and Messrs. Hersent, is essentially the same as that of Sir John Fowler, except that the new harbour which he proposed to construct on the French coast at Andrecelles, on account of the deficiencies of the then existing harbours at Calais and Boulogne, has been rendered unnecessary through the improvements that have since been made at Calais. For the reception of boats at Dover the proposal is to construct a well-equipped marine station, where the transfer of the vehicles from the railway lines would be effected under the best conditions. For this part of the work Sir Douglas Fox is the engineer, and similar facilities would be provided at Calais. The difficulty presented at these ports by the large rise and fall of the tide is to be overcome by the use of big electric lifts.

On arrival the vehicles will be shunted on to the lift, and after it has been lowered to the appropriate level they will be hauled on board the boat over a short movable bridge by means of electrical windlasses, the whole operation taking a maximum of four minutes. For the sea passage four vessels are to be provided in the first instance, Sir William White being the naval architect. Of these, two, devoted to passenger service alone, are to be turbine steamers with a speed of 22 or 23 knots, and two cargo-boats of about 13 knots. The passenger boats are to be, in effect, moving stations; the two lines of rails on which the carriages will stand are to be completely covered in, so as to be protected from the weather, and there is to be a full allowance of saloons, refreshment rooms, etc., so that passengers who care to leave their seats will find ample accommodation. It may be mentioned that the International Sleeping Car Company has already prepared plans for a special train de luxe, weighing 380 tons, to be employed on the service. The whole scheme is to be controlled by a company having a capital of one million.

A PERTINACIOUS CURRENT.

LECTURE BY SIR OLIVER LODGE.

At the Royal Institution on Friday evening last, Sir Oliver Lodge lectured on the subject of "A Pertinacious Current," a title which appears to have excited not a little curiosity. In his opening remarks Sir Oliver paid tribute to the important part played by that Institution in stimulating research. Referring to the new developments and discoveries in the domain of chemistry, as lectured on recently by Professor J. J. Thomson, he expressed the opinion that in physical and chemical science we were living in what he might term a fresh Newtonian epoch, and that it was well for us to realise this.

By the term "pertinacious current" he meant simply a high potential continuous current, a current going in one direction persistently in spite of obstacles which might be put in its path. He had been looking for such a current since 1884, and he had only recently been able to produce it. Such currents were of course obtainable by means of a battery of a quarter of a million cells, but that was a very inconvenient and expensive process, and he desired to obtain such a current by what he might term engineering methods, that was to say, in connection with a dynamo.

The method of obtaining high potential continuous currents was by the use of a one-way electric valve or rectifier. Thus, if the secondary of a Ruhmkorff coil were connected to a Leyden jar, then the provision of a rectifier which would allow the supply current to pass in, but prevent all exit, would enable the jars to be charged to bursting pressure, by a succession of intermittent pulses, so that a pertinacious current of discharge from the jar, through a leak or other high resistance, could be maintained. Sir Oliver showed an experiment in which he produced a London fog in a large glass globe, and by means of the discharge of such a current from a point connected to a jar, which was only momentarily connected with the source of supply, dissipated the fog, and he pointed out the obvious advantage of being able to do this by engineering methods rather than by having recourse to delicate high-tension electro-static machines. With reference to the manner in which these rectifiers work, the theory was put forward that their action is due to the rapid clearing away from the neighbourhood of the anode of all the carriers of positive electricity by means of the bombardment from the cathode, and to the fact that the current could only be conveyed by the agency of these positive carriers when they were allowed to come into actual contact with the positive terminal and travel to the back of the negative. It followed that the current that required their presence in that position was stopped if they were cleared away by bombardment, but the reverse current which required their presence at the other terminal could be easily transmitted if that terminal were screened. The bombardment was found in time to drive the gas out of the vessel, and in that way to create a very high vacuum, so that no current at all could pass, and it was therefore necessary to employ in the rectifier a vapour such as that of mercury, the supply of which could easily be maintained from a pool of the metal inside the vessel. The Cooper-Hewitt mercury lamp has been adapted for use in this way. Sir Oliver supported his theory by numerous diagrams and experiments.

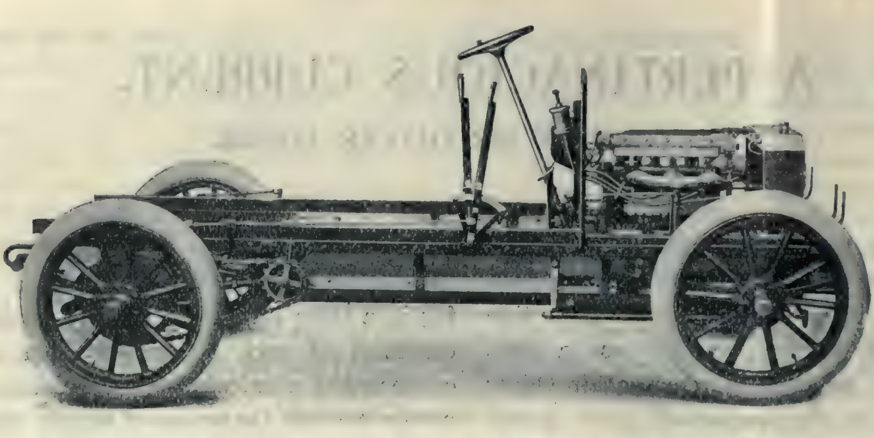


FIG. 1. MAUDSLAY 20-B.H.P. THREE-CYLINDER CHASSIS.

MOTOR NOTES.

MAUDSLAY MOTOR COMPANY, LTD.

THIS company has recently laid out a portion of its works for the manufacture of heavy vehicles, and it is also adapting its engines to marine work. There is little doubt that a great future awaits the internal combustion engine in its adaptation to the needs of the shipping industry, and the practice of supplying marine motors of the car type, or at least with all the chief characteristics of car design will be modified as the outcome of experience. Even at present the design of the Maudslay marine motor has been carefully revised in certain details, such as the starting gear, lubrication, and ignition.

The materials throughout are those best suited to withstand the corrosive action of salt water, and no aluminium is used where there is a possibility of its being affected by contact with sea water.

Accessibility to the various parts has received very careful attention. The valves can be very quickly removed owing to the special construction of the hinged layshaft. The countershaft bearings can be inspected and adjusted through the doors on the side of the base-chamber, and, if necessary, the pistons and piston-rods can be taken right out through these doors without disturbing any of the main joints of the motor.

All the moving parts are carefully balanced, and the weight of the reciprocating parts reduced to a minimum, the result being that Maudslay three, four and six-cylinder motors are claimed to create practically no vibration.

With the smaller sizes of Maudslay motors are fitted reversing and feathering propellers, and with the larger sizes a reversing gear, which is entirely enclosed in an oiltight case, and runs in a bath of oil so that there is said to be no possibility of its action being affected by the sea water.

The general design of the company's cars remains unaltered save in one or two details, making towards quicker and easier running. The 20 b.h.p. three cylinder engine is shown in fig 2. The valves open direct into the cylinders over the top of the pistons.

Two throttle valves are fitted in the inlet branch, one connected to the small hand-lever on the top of the steering heel, and the other connected to the clutch pedal so that when the clutch is withdrawn the engine is automatically throttled. As an alternative arrangement, a governor is mounted on the vertical shaft which drives the lay shaft, and a foot accelerator to cut the governors out when required.

STAR ENGINEERING COMPANY.

The exhibit of this firm attracted a good deal of attention at Islington. The company showed one 10-h.p. chassis, one 7-h.p. chassis, one 7-h.p. car, brougham top, one 7-h.p. tonneau three-seated body, one 7-h.p. two-seated body, one 7-h.p. doctor's car, Victoria body, and one 15-h.p. car. A section of the 7-h.p. engine is shown in fig. 3. It is a balanced twin cylinder motor, the two cylinders being cast together. Automatic inlet valves are fitted with electric ignition. The bore is 3½ in., stroke 4½ in., and the normal speed 800 revolutions per minute. The company fits its well-known system of transmission gearing with three-point suspension, three speeds, and reverse, all actuated by one lever. All gear wheels are machine-cut from

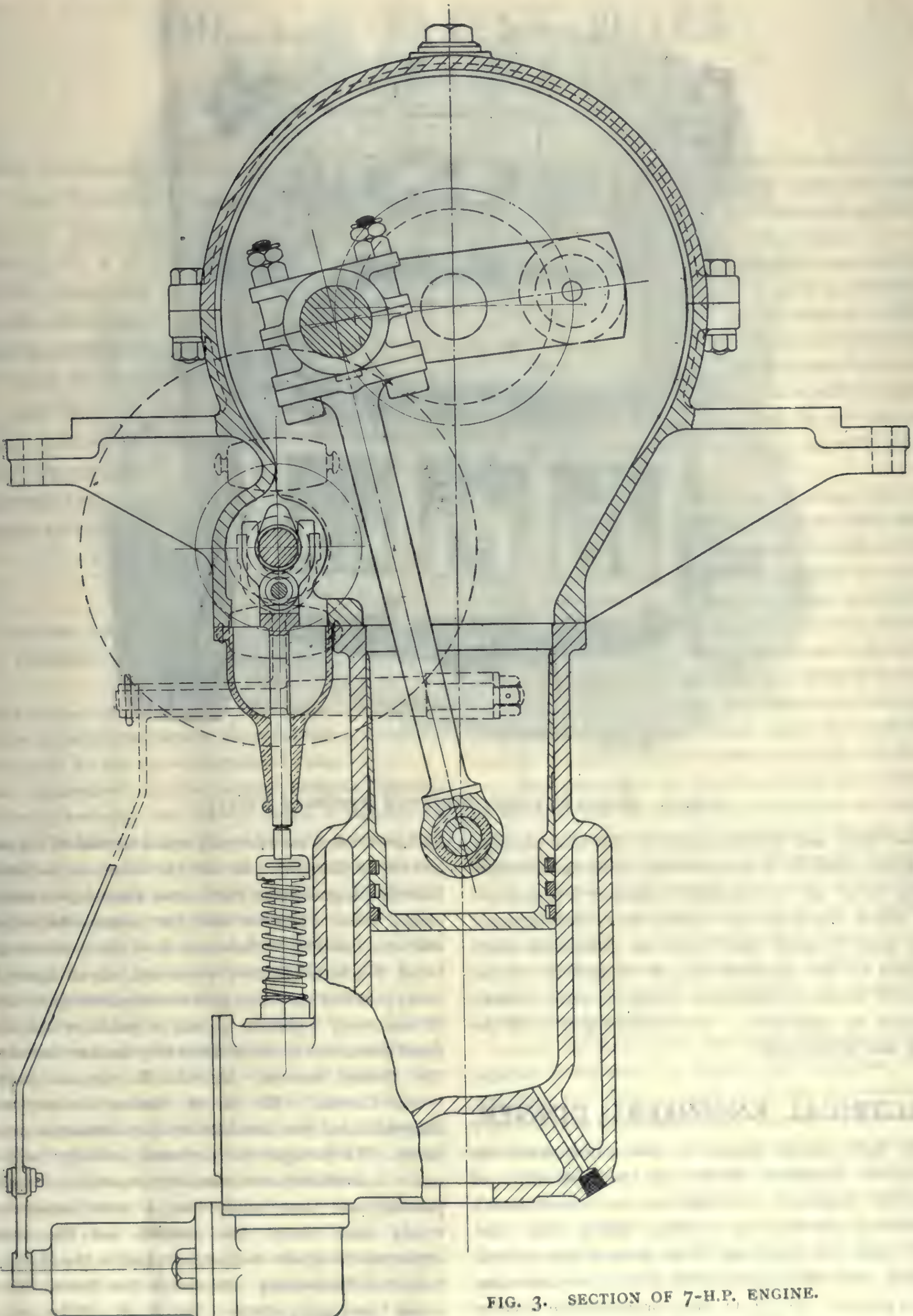


FIG. 3. SECTION OF 7-H.P. ENGINE.
STAR ENGINEERING CO., LTD.

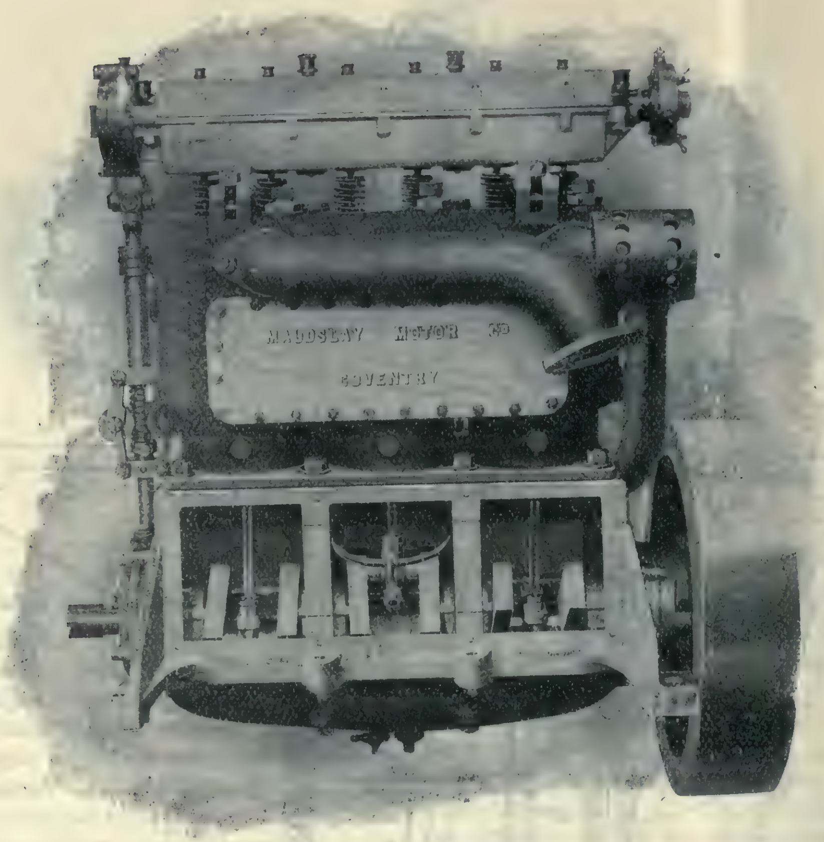


FIG. 2. 20-B.H.P. THREE-CYLINDER MAUDSLAY ENGINE.

selected steel, and case-hardened by the Star process. The frame axles are of special design, and the standard springs fitted are of carefully tempered spring steel. The brakes fitted on the chassis illustrated in fig. 1 are a metal to metal band brake on differential shaft actuated by foot pedal and a pair of powerful metal to metal internal expanding brakes on road wheels, operated by hand-lever. The steering gear is of the worm and sector type.

ELECTRICAL ENGINEERS' DINNER.

The first annual dinner in connection with the Manchester Students' Section of the Institution of Electrical Engineers was held in the Grand Hotel, Manchester, on Saturday evening, March 18th. Mr. C. D. Taite, the chairman of the Manchester Section, presided, and there were about eighty members and friends present. Mr. F. O. Mills proposed the toast of "The Institution of Electrical Engineers." and said that although the Manchester Students' Section had only been in existence for about one and a half years, it had grown to a membership equal to that of the similar section in London. Mr. C. D. Taite, in responding, heartily congratulated them upon the progress they had made. Last April, he said, the number of members was one hundred; they had now three hundred. A Local Students' Section possessed advantages from many points of view, and gave the members opportunities of discussing technical points in public which was of great usefulness to them when they became members of the Senior Section. Mr. A. E. Jepson proposed "Our Guests." Mr. E. W. Cowen, in responding, congratulated the members on the successful progress made. He thought the electrical industry had been under a cloud for some time, but hoped that it was now passing, and that before long a great improvement would take place. He pointed out the splendid opportunities which the members had in the Manchester School of Technology, and also in the British Westinghouse Company's works. Mr. R. W. Willis proposed "The Scientific and Technical Societies of Manchester," to which Mr. O. Lemon replied. A good musical programme was provided.

THE 1905 PATENT RULES.

IMPORTANT MEMORIAL.

THE following letter and memorial have been forwarded to the President of the Board of Trade by Sir Lloyd Wise. The memorial is a most weighty representation, whether measured by the eminence of the scientists who have signed it, the millions of capital represented by the manufacturers who have done so, or by the thousands of workmen they employ. As will be gathered from the opening part of the letter to Lord Salisbury, the signatories constitute in other respects a truly representative body. The memorial bears between 500 and 600 signatures.

46, Lincoln's Inn Fields, London, W.C.,
25th March, 1905.

To the Most Noble the Marquis of Salisbury, C.B., P.C.,
President of the Board of Trade.
Patents Rules, 1905.

MY LORD,—Herewith I have the honour to submit for your lordship's favourable consideration a memorial with respect to the above-mentioned rules.

The signatories include many eminent persons and firms, amongst the former being a number of prominent Fellows of the Royal Society, several past presidents of the Institution of Civil Engineers, the president and several past presidents of the Institution of Mechanical Engineers, the president-elect and several past presidents of the Iron and Steel Institute, several vice-presidents and members of council of the Institution of Naval Architects; also presidents, past presidents, and members of council, Fellows, and members of various other influential bodies, engineers, metallurgists, and chemists, many well-known professors, solicitors, and experienced patent agents, numerous inventors, patentees, and others interested in furthering the progress of industry by the introduction of improved processes and products.

In transmitting this memorial may I be permitted to submit to your lordship that—

1. For over thirty years the adoption has been advocated of a measure on the lines of Section I. of the Patents Act, 1902.

2. The object in view was to afford, both to the inventor and to the public, the benefit of an official examination as to novelty, without, however, incurring the serious risk of inflicting injury upon an inventor by refusing a patent for alleged want of novelty o by making public adverse official opinions.

3. Prior to the Act of 1883 a memorial was presented to Mr. Chamberlain in favour of such a scheme, but presumably, owing to the great expense involved, he did not provide in that Act for official examination as to novelty. Nevertheless, that portion of the scheme which provided against publication of official opinions in unopposed cases was embodied in the Act (sub-section 5 of section 9 of 1883 Act, as amended by 1888 Act).

4. The original idea was simply to ensure that where the applicant for a patent and the authorities differed as to patentability, the authorities should have the right to compel the applicant to mention in his own specification any prior specification or specifications a knowledge of which might seem to be necessary to enable the public to form an accurate opinion as to the patentability of the applicant's alleged invention.

Thus the public would be amply protected, less moral responsibility would be thrown upon the authorities, and the inventor would be given absolutely fair play.

5. The new rules, on the other hand, are obviously based upon the idea that the authorities are charged with the responsibility of publishing to the world an official opinion whenever it appears to them that no patentable invention is disclosed, and although the Act only provides for insertion of a reference in an applicant's specification (which must, according to the principal Act, end with the claim), Rule 10 actually goes so far as to prescribe an endorsement outside the legal limits.

Surely the Act would not have expressly provided against publication of reports of examiners if the intention had been to cast upon the authorities the responsibility of advising the public as to patentability, as distinguished from merely requiring the applicant to refer to any prior specifications, to which, in the opinion of the authorities, the public ought to have their attention drawn, in order not to be misled by an applicant's specification, deemed, in the absence of such reference, to be wanting in clearness or otherwise misleading.

6. It is pretty generally recognised that, with thousands of cases to deal with every year, there will be cases

in which the Comptroller and his staff, and even the law officers on appeal, will form erroneous conclusions, to the irreparable injury of inventors; whereas nobody could be irreparably injured by failure to endorse upon an applicant's specification an adverse official opinion.

7. I gather that official references to prior specifications will only be insisted on when the applicant or his agent does not amend his claims so as to avoid the references cited, or does not acknowledge or disclaim the prior state of the art.

Let us test the value of this. To that end let us assume the extreme case of an applicant filing as his specification a verbatim copy of a previously published specification less than fifty years old, but with a specific disclaiming reference to that specification, thus: "I am aware of the specification of Letters Patent No.—— dated—— granted to—— and I make no claim to anything described or claimed therein.

What would the Comptroller do in that case?

I am not without reason for believing that he would place an official endorsement upon the specification, notwithstanding that it already contained a specific reference to the prior specification by way of notice to the public, so that any one interested in the matter would naturally be led to compare the two specifications and at once realise the position.

Why, then, would the official notification be placed upon the specification?

The obvious inference is that it would be done, not merely to notify in accordance with the Act the existence of the prior specification, but for the express purpose of communicating to the public the opinions of the Comptroller and Examiner that the invention had been wholly anticipated, and that the patent was therefore bad.

It may be urged that in such a case no injustice would result.

On the other hand, it would be equally true to say that in such an obvious case no advantage to the public would result from the official endorsement.

But that is not a sort of case likely to arise in actual practice.

Once concede that, notwithstanding specific reference to a prior specification by the applicant in his own specification, an official notification may nevertheless be endorsed upon that document, the door to injustice and oppression is at once opened.

The real danger will arise where the officials regard as identical things that are not really identical.

It is inconceivable that such cases should not occur, remembering the more or less perfunctory way in which applications numbering thousands upon thousands every year will necessarily have to be dealt with on mere paper comparison.

As an experienced professional witness told the departmental committee, 'An examiner is like a patent agent; he is not infallible."

And the late Mr. John Imray, an exceptionally experienced practitioner, when giving his evidence, said, "A man looking at a publication, say, thirty or forty years old, when he has an invention before him reads that in a very different spirit from that in which he would read it if he had not known of the invention then before him. Therefore he interprets that very often as an anticipation which is no real anticipation. We know this, that in the High Court of Justice it requires the most profound judicial heads often to distinguish what is anticipation and what is not, and that task cannot be entrusted to any number of examiners."

And, again, "My experience in the Patent Office is, in Germany and the United States and Sweden, that they are not capable of looking at it in the right way; but that they call things anticipations which are not really anticipations."

The rules are so framed that an endorsement upon a specification according to Rule 10 will be at least equivalent to an official notification that in the opinion of the Comptroller the specification is open to objection on the ground that the invention claimed thereby has been wholly or in part claimed or described in the previous specification.

That is going far beyond merely requiring reference to the prior specification to be made in the applicant's specification, where it would operate to cure the defect.

But Rule 10 goes much further, by providing that where the reference is inserted as the result of a provisional report under Rule 7 a statement to that effect shall be added to the reference.

This is exactly the same thing as if the Comptroller should place upon the applicant's specification a statement in these words, viz.: "The examiner has reported to the Comptroller that in prosecution of the investigation prescribed by subsection 1 he has found that the invention claimed in this specification has been wholly claimed or described in the prior specification above cited."

With great deference I fail to see how it is possible to justify such a course in the teeth of subsection 4 of section 1 of the 1902 Act, which makes applicable to such reports the provisions of subsection 5 of section 9 of the principal Act, as amended by any subsequent enactment, thus expressly prohibiting the publication or opening to public inspection of the reports of examiners.

Referring to official endorsements, the Right Hon. Joseph Chamberlain, when introducing the Bill of 1883, said : "This would practically come to the same thing as the rejection of the patent, as no manufacturer would deal with a patent so endorsed."

Again, in a recent article in The Times Financial and Commercial Supplement it is pointed out, with respect to the proposed official endorsements, that : "A reference of this kind will, of course, seriously reduce in the public estimation the value of a patent, and great care will, therefore, have to be taken that no injustice is done to the inventor. The public does not realise as do those familiar with patents and patent litigation how very difficult it is in many cases to decide that an invention is covered wholly or partially by a specification of earlier date, and even though a specific reference be not intended to have the effect of such a decision, it will be so interpreted by the public."

"Specific reference" in that article means, of course, an official endorsement according to Rule 10.

8. No part of the Act appears to justify the making publicly known the nature of either an examiner's report or the Comptroller's opinion, as provided for by Rule 10, and so long as the rule remains in its present form neither the Comptroller nor any other official charged with giving effect to it can avoid the adoption, at least occasionally, of a course which, as is submitted, will contravene the Act. In other words, the Act does not authorise the Comptroller to endorse (as Rule 10 practically requires him to do) his opinion or the examiner's opinion upon an applicant's specification.

9. That the Comptroller and all other responsible officials will use every effort to give effect to the rules judiciously and so as to cause the "minimum" amount of friction is not doubted. But very many experienced persons share the opinion expressed in The Times article already referred to that "the danger will be more apparent in the days to come, when a staff is in power which has only known the new system, and it is almost certain that then friction will frequently occur between the authorities and the applicants for patents."

10. In conclusion then, I respectfully submit (*a*) that the public interest will be amply protected in even the closest case by mere mention of the prior specification or specifications by number, date, and name by the applicant himself in his own specification, that the form of reference provided by Rule 10 is antagonistic to the spirit of the Act, because such references will have the effect of communicating to the world the pith of the Comptroller's adverse opinion, and, where Rule 7 is referred to, will be equivalent to publication of the examiner's report in defiance of the express provision of subsection 4 of section 1 of the Act of 1902 ; (*b*) that the Act does not authorise the Comptroller to officially endorse an applicant's specification ; (*c*) that, even assuming the endorsements to be legalised, they would only be justifiable in case an applicant failed to specifically mention in his own specification the prior specification which he had been informed the Comptroller (after having heard the applicant) considered it necessary to mention ; (*d*) that such endorsement should be in a form which would not impart to the public the nature of the Comptroller's opinion, much less the pith of the examiner's report.

I have the honour to be, my Lord, your Lordship's
most obedient servant,
W. LLOYD WISE.

MEMORIAL.

January, 1905.

To the Right Honourable the President of the Board of Trade.

SIR,—

The Patents Act, 1902, and the Patents Rules, 1905.

To the Departmental Committee on whose report the Act was based there was sent, in 1900, an influentially-signed communication, to the following extract from which we earnestly invite your attention :—

"As, however, patents have sometimes been ultimately supported in respect of inventions which even eminent judges have regarded as not patentable, it is not advisable, in any unopposed case, that letters patent should be refused on the ground that the invention, or alleged invention. . . . has been previously patented in this country, provided the applicant (if required) so amends his specification as to indicate what was previously known, thus protecting the public against being misled. Furthermore, it is not advisable either to make it publicly known that the specification has been amended at the instance of the Patent Office authorities, or to give publicity to any official notification of any kind (whether by endorsement on the specification or otherwise) implying doubt as to the novelty of the subject-matter in respect of which letters patent are granted, because such publicity would obviously create prejudice against the patent ; and, where based upon erroneous opinion, would operate unjustly."

As Rules 9 and 10 now stand, however, when the Comptroller determines that reference ought to be made in the applicant's specification to a prior specification or specifications by way of notice to the public, the form of reference must be as follows and be inserted after the claims :—

"Reference has been directed, in pursuance of section 1 subsection 6, of the Patents Act, 1902, to the following specification of Letters Patent No. . . . . . granted to . . . ."

Where the reference is inserted as the result of a provisional report under Rule 7, a statement to that effect must be added to the reference.

Such a reference will virtually make public the pith of the examiner's report, notwithstanding the enactment that reports of examiners shall not in any case be published or be open to public inspection (subsection 4 of section 1 of 1902 Act, and subsection 5 of section 9 of 1883 Act, as amended by 1888 Act).

Moreover, although based upon mere opinion, which may be erroneous, it will usually render a patent commercially worthless.

This is a very serious matter, seeing that, in the past, large manufacturing concerns, which have rendered public service by introducing articles of great utility not previously on the market, besides giving employment to many thousands of workmen and others, have accomplished these beneficial results under patents for inventions as to the novelty of which (in the patentable sense) expert and even judicial opinions have differed.

We, therefore, hope that it will be found possible to forthwith so modify the rules as to obviate the unnecessary risk they at present involve of seriously retarding the introduction of improvements which, though individually of a minor character, do, in the aggregate (to quote the Select Committee of 1872), contribute greatly to the progress of industry.

To this end we venture to suggest revision in the sense that in no case shall either an official notification be endorsed upon, or a stereotyped form of reference be inserted in an applicant's specification, unless and until he shall have been notified of the Comptroller's determination, and shall have been afforded, and shall have failed to exercise, the option of himself inserting in his own specification a reference, by number, year, and name (and not in a stereotyped form) to the prior specification (or specifications), reference to which the Comptroller shall have determined ought to be made in the applicant's specification by way of notice to the public.

We submit that the Act does not provide for official insertion in, or endorsement upon, an applicant's specification of any notification; and, moreover, that, as the specification is addressed to the public, a reference in it to a prior specification or specifications, inserted by the applicant himself, would obviously constitute a notice thereof to, and would adequately protect the public, without necessarily injuring the applicant, as any official notification inevitably will.

Should it, however, be insisted that the modified procedure we recommend cannot be adopted as the law now stands, then, regard being had to the importance of the interests involved, we trust his Majesty's Government will see fit to introduce a short Bill in the coming Session of Parliament, with a view of clearly legalising the proposed change in the rules.

We have the honour to be, Sir, your most obedient servants.

(SIGNATURES FOLLOW.)

Among those who signed the petition were the following: Lord Kelvin, Professor J. O. Arnold, Mr. John A. F. Aspinall, Mr. Edwin Adams.

Sir William H. Bailey, Sir Benjamin Baker, Mr. A. F. Berry, Sir Nathaniel Barnaby, Professor Biles, John Brown and Co., Ltd., Bell's Asbestos Co., Ltd., Browett, Lindley and Co., Ltd., Mr. D. Bain, Professor Barr, The British Luxfer Prism Syndicate, Ltd., Sir Henry Bessemer and Co., Ltd., Mr. W. Worby Beaumont.

Sir E. Hamer Carbutt, Bart., The Central Marine Engine Works (W. Gray and Co., Ltd.), Professor D. S. Capper, Mr. Henry Chapman, Mr. Samuel Chatwood, The Castner Kellner Alkali Co., Ltd., Clayton and Shuttleworth, Ltd., Mr. W. H. Caldwell, Major-Gen. Sir J. F. Crease.

Sir Raylton Dixon and Co., Ltd., Dick, Kerr and Co., Ltd., Dr. Bernard Dyer, Symmers Day and Co., The Ebbw Vale Steel, Iron and Coal Co., Ltd., The Edwards Air Pump Syndicate, Ltd., Dr. Francis Elgar, Sir J. Fortescue Flannery, Bart., M.P., Mr. Edward Field, Frame Food Company, Ltd., Mr. L. F. Gjers, Sir Howard Grubb, Geipel and Lange.

Mr. R. A. Hadfield, Holden and Brooke, Ltd., Mr. H. Graham Harris, H. and W. Hawthorn, Leslie and Co., Ltd., Hick, Hargreaves and Co., Ltd., J. H. Holmes and Co., Mr. James Holden, Mr. Andrew Johnston, Professor A. B. W. Kennedy, The Leeds Forge Company, Ltd., The Leeds Phosphate Works, Ltd., Mr. Frederick Mills, Sir William Mather, Mather and Platt, Ltd., Mavor and Coulson, Ltd., Mr. D. B. Morison, Marshall, Sons and Co., Ltd., Merryweather and Sons, Mr. Charles H. Merz, Dr. Ludwig Mond.

Musgrave and Sons, Ltd., Mr. W. M. Mordey, Mr. W. H. Maw, Mr. Edward P. Martin, The Pulsometer Engineering Company, Ltd.

Sir Edward J. Reed, Professor W. Ripper, Mr. Mark Robinson, Sir Thomas Richardson, Mr. John S. Raworth, Professor Henry Robinson, Mr. E. Windsor Richards, Sir Henry Roscoe, Mr. Robert Ropner, Sir William Ramsay.

Mr. James Swinburne, Spencer, Moulton and Co., Ltd., Mr. Charles Scott, Sir J. Wilson Swan, Mr. J. E. Stead, J. Stone and Co., Ltd, Spillers and Baker, Ltd.

Mr. John Tweedy, Professor Silvanus P. Thompson, Sir John Thornycroft, John I. Thornycroft and Co., Ltd., Colonel Sir C. E. Howard Vincent, Mr. H. S. Wainwright, Mr. J. H. Wicksteed, Mr. J. M. While, Mr. W. P. Wrightson, The Wallsend Slipway and Engineering Company, Ltd., Mr. A. F. Yarrow.

NAVAL NOTES.

GREAT BRITAIN.

TWO more destroyers, the *Swale* on March 20th and the *Garry* on the following day, have been launched, making a total so far this year of eight. The *Swale* is of the same type as the other destroyers of the 1903–4 programme, but an entirely new form of hull has been adopted in the case of the *Garry*, and her trials are expected to be unusually interesting.

The *Forward* scout begins her trials this week, and the *Pathfinder* has already half completed hers. The *New Zealand* having developed slight machinery defects had to abandon her four-fifths power trial after running for fifteen hours at an average speed of 18 knots, but the *Devonshire* cruiser has successfully completed the second trial and attained a speed of 21 knots.

FRANCE.

The decision of the Minister of Marine on the question of the design of the *Waldeck Rousseau* has been announced, and it seems that this vessel is to be of the dimensions of the *Edgard Quinet* (with a higher speed), but the armament will be similar to that of the *Jules Ferry*. That is to say, her displacement will be 13,700 tons, length 515 ft., beam 70 ft., draught 26½ ft.; her engines are to be of 36,000 h.p., and to give her a speed of 23 knots. For armament she will carry four 7·6 in. sixteen 6·48 in., twenty-four 1·85 in., and two 1·45 in. guns. The estimated cost is £1,163,080, and she is to be completed in four years from the date of commencement, which will be sometime at the end of this summer, as the *Jules Michelet* will occupy the only available slip until then.

ITALY.

The trials of the *Regina Margherita* have been completed with fairly satisfactory results. On her first trial at 14,000 h.p. she attained a speed of 19·3 knots, and later with 20,600 h.p. the speed was 20·2 knots. It will be noted that for an increase in power of nearly 50 per cent. the increase in speed was slightly less than one knot, and this is a matter the Italian authorities might well give attention to. With some of our *County* cruisers, a rather similar experience occurred, and it was not until the propellers had received attention that the vessels were able to give such excellent performances as they are now capable of. The *Regina Margherita's* boilers are of the Niclausse type.

JAPAN.

The estimates for 1905–06 come to a total of 780,000,00 yen (£19,500,000), including ordinary and extraordinary expenditure.

Three new destroyers, built in Japan, have been commissioned, the *Ariake*, *Fubuki*, and *Arare*, all of 29 knots speed.

The new Japanese battleship *Kashima* was launched at Elswick on Wednesday. She has a displacement of 16,400 tons, and is 455 ft. long, with 78 ft. beam, and 26 ft. 8 in. draught. Fully equipped, her displacement will exceed 17,000 tons. She carries the very powerful armament of four 12-in. guns in her two main barbettes, four 10-in. guns singly in barbettes, twelve 6-in. guns in the citadel, twelve 12 pr., three 3 pr., six Maxims, and five torpedo tubes. The armament has been so placed that the pieces shall not interfere with each other in firing, and every gun has a considerable arc of training. The armour amidships is carried from the water line to the upper deck with 4-in. screens, rising 7 ft. 6 in. higher, and covering the 6-in. gun positions amidships as well as the spaces between the 10-in. gun positions. The main armour belt extends the whole length and is 9 in. thick amidships tapering slightly at the extremities. It extends 5 ft. below water and 12 ft. 6 in. above, while the side plating on the higher level is 6 in. thick amidships, with 6 in. of steel for the citadel. Here are ten 6-in. guns separated by screens and firing through ports similar to those in casemates. The other two 6-in. guns are on the upper deck amidships, behind the 4-in. screen, which has been alluded to. The 12-in. barbette armour varies from 9 in. to 5 in., while the 10-in. barbettes have 6-in. armour. The steel protective deck is 2 in. thick on the flat, and 3 in. on the slopes which go down to the bottom of the main armour deck. There is also a thick protective plating worked on the top of the screen armour at the level of the boat deck. The ship is provided with twenty Niclausse boilers, and the speed is to be 18½ knots. She will have two large steel masts, each having searchlights and gun-controlling platforms. Helm indicators are provided, and there will be an elaborate installation of telegraphs, voice pipes and telephones. The complement of the ship will be about 980 officers and men.

The sister ship *Katori* is expected to be launched in the course of a few days.

HIGH-SPEED RAILWAYS.

THE KEARNEY-THOM SYSTEM.

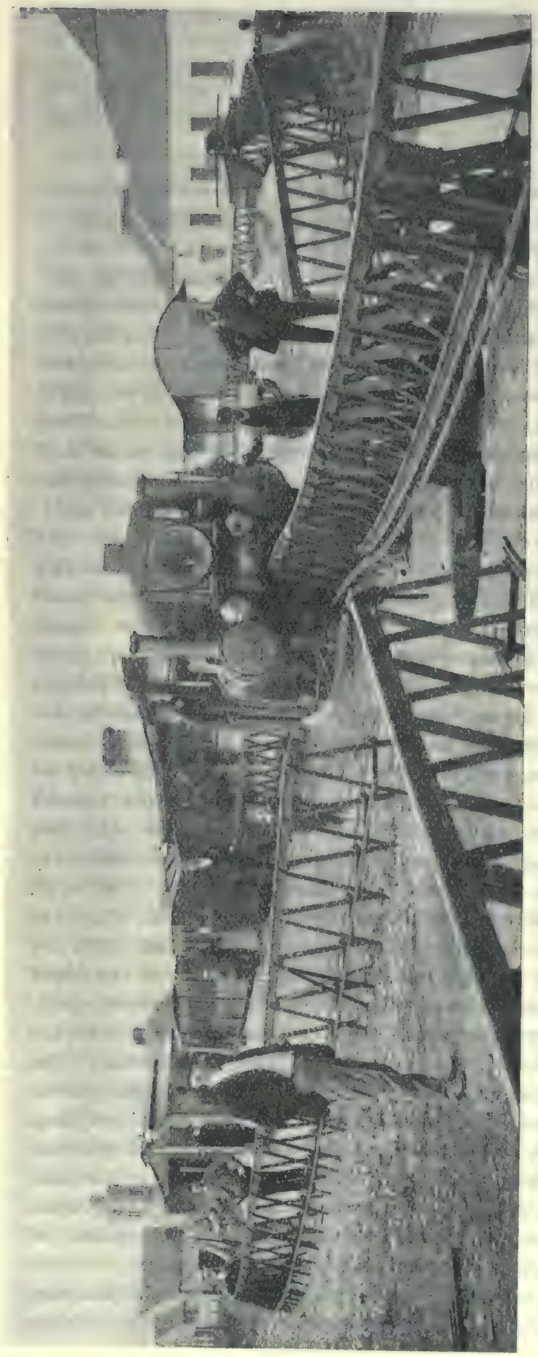


FIG. I. MONO RAIL STEAM LINE (BEHR SYSTEM) BETWEEN LISTOWEL AND BALLYBUNION, IRELAND.

INVENTORS are constantly applying their energies to a solution of the problem of devising a cheap and effective high-speed rail track. The mono-rail principle is a favourite one with experimenters in this field. The first idea of a single line rail dates back for a century, but of modern systems one of the best known in the Behr, illustrated in fig. 1. To the inventor belongs the credit of designing the first mechanically-driven train on a single rail track, and the line from Listowel to Ballybunion has amply demonstrated the safety of the system.

Another system of proposed electric traction to which attention has lately been directed is that known as the Kearney-Thom, for which the Rev. R. Riach-Thom is mainly responsible, and which Mr. E. W. Chalmers Kearney is developing and exploiting. In this system the whole weight of the carriage (fig. 2) is borne by the ground rail. To keep the carriage in an upright position a grooved upper rail is employed. The superstructure for the support of the upper rail is made of channel steel, which it is claimed gives the necessary rigidity. Lessened friction, the simplicity of points and crossings, the possibility of using very light cars, and adaptability to overhead and tube railways are some of the special features of this invention. It is stated that in the case of tube railways a considerable economy in construction is effected by the use of tunnels of smaller diameter, owing to the fact that the bottom rail can be bolted to the tube itself.

In fig. 3 is shown a side elevation, displaying all rollers in position, with method of gearing from armature shaft to driving axles by means of three spur wheels. Here A is the armature shaft; B the motor; C gearing with three wheels; D circular segments with iron plates secured to them to bear the side rollers; E a driving wheel; F frame of bogie; G rollers at end for up and down movement; H side rollers for taking curves; J side vertical rollers for use when bogie is on a curve; K body of car; L circular ring or path for rollers attached to body of car; M a safety catch plate, put on at each side of bogie under the side rollers, and fastened by screws at each end.

Fig. 4 shows cross-section of car, and the following will explain the construction: *A* seats; *a*1 windows; *a*2 floor framing; *a*3 one of the ribs; *B* standards;

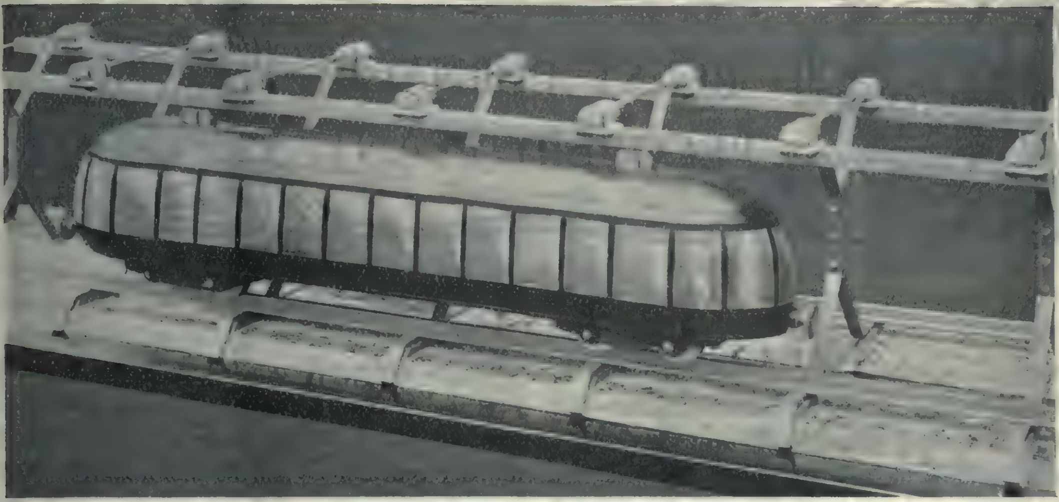


FIG. 2. KEARNEY-THOM SYSTEM. THE LATEST APPLICATION OF THE SINGLE RAIL TRACK.

b insulators; *b*1 the rods; *b*2 bottom sleeper; *b*3 dogs to hold rail and sleeper; *b*4 chocks or stoppers for insulators.

FEATURES OF THE KEARNEY-THOM SYSTEM.

As already stated, superiority over other methods is claimed for the Kearney-Thom in the simplicity of points and junctions, and in the adaptability of the system to very light cars. At the same time the maximum of tractive force is said to be obtained by the whole weight of the car being directly on the driving wheels, so that high acceleration can be obtained with economy. Provision would be made for wheel breakages so that in the event of such a contingency arising the cars would still be held in their normal position by means of checks. In the Kearney-Thom system only six wheels are used for each car; four bearing wheels (2ft. 6in. in diameter), which are doubly flanged, and are arranged in sets of two at each end of a car. Four motors of 50-h.p. each would be used for ordinary speeds, but on a high speed line eight motors would be used, two on each wheel, one either side; the individual h.p. would also be considerably increased. It is claimed that a speed of 150 miles per hour could be attained.

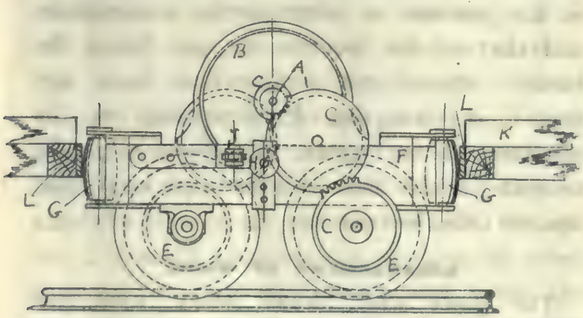


FIG. 3. SIDE ELEVATION, SHOWING ALL ROLLERS IN POSITION. KEARNEY-THOM SYSTEM.

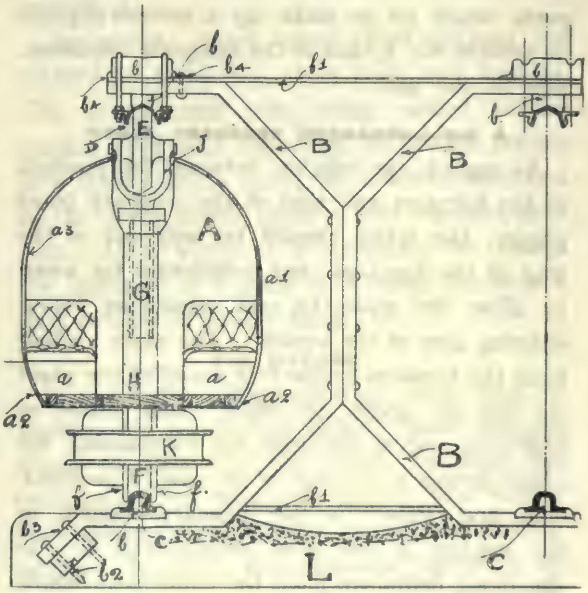


FIG. 4. CROSS SECTION OF CAR. KEARNEY-THOM SYSTEM.

BLAST FURNACE RECOVERY PLANT.

By J. Gillespie.

THE heating properties of the furnace gases had been in use for some time as the agents for raising steam for blowing and other engines and for heating blast for the furnaces, but it was not till 1879 that any successful attempt was made to recover tar and ammonia from blast furnace gases.

The various systems and patents divide themselves into two classes—I borrow here the classification given by Lunge—(1) "Methods depending on the condensation or cooling of the gas"; (2) "Methods depending upon the use of acids, without the cooling of the gas." I propose to describe the various vessels and parts which go to make up a recovery plant on system No. 1, that of the complete condensation of the gas.

A WELL-ARRANGED RECOVERY PLANT.

As regards the relation between the position of the furnaces and that of the recovery plant proper, the latter should be well out of the way of the furnaces, and sufficiently far away to allow the gases to cool somewhat before entering any of the vessels. The main leading from the furnaces to the first vessel of the plant we call the green gas main; seal boxes or hydraulic valves are used for bye-passing the plant during a stoppage or in case of accident. The first vessel is the primary washer, or tar washer as we now usually call it; in the block below we have the condensers whose name explains itself. The order of the next three portions of the plant varies in different works, in some cases we have one liquor washer placed before the exhausters and one after, but in other works, and these include the most recent, we find the exhausters placed immediately after the condensers, and both washers after the exhausters. The main going back to the stoves and boilers from the final washer we know as the return gas main.

In the briefest outline this enumerates the essential portions of the plant, the green gas main or mains, the tar washer, the condenser, the exhausters, the first and second liquor washers and the return gas mains. The great volume of gas to be dealt with from even a single furnace, causes the dimensions of a recovery plant to be considerable, and nothing has ever been gained, but much has been lost, through keeping down the sizes of mains and vessels. Though it is customary to reckon the volume of gas to be dealt with as 140 to 150,000 cubic feet per ton of coal put into the furnace, it must be borne in mind that this is the volume at atmospheric temperature, and that at the moment the gas leaves the furnace top, at any temperature from 400 deg. F. to 600 deg. F. depending on the condition of the furnace, its volume is nearly, or quite, double that indicated; it is at least 250,000 cubic feet per ton.

ARRANGEMENT OF MAINS.

The gases when drawn away from the furnace top are conveyed down vertical pipes into the main common to all the furnaces.

The quantity of gas produced by one blast furnace of ordinary dimensions varies from 12 to 15,000,000 of cubic feet per day, and to allow of a reasonable rate of travel, the main requires to be made of large size, for four furnaces about 7 ft. or 8 ft. diameter and for six furnaces not less than 9 ft. The rate of travel is about 800 ft. per minute, this looks very high but is approximately right as any who has watched the gas passing through a plant for the first time will readily appreciate; it seems no time at all from the moment the first dirty gas enters the plant till it is up to the exhausters and ready for their action. The gases entering the green gas main are at a high temperature and it is necessary to line the main with firebricks to prevent too rapid condensation of the gas and consequent deposit of tar in the main. If this main be fixed in its position at both ends, it is necesary to provide means of expansion in its length on account of its variations in temperature.

There is not much possibility for improvement in such a simple construction as a collecting main, but one such improvement has been carried out in the work last erected in Scotland. The green gas main has been duplicated throughout the full length of the furnaces, that is to say, there are two full-sized mains with separate connections to each furnace.

Each of these connections can be closed off from the furnace by a valve near the top. At the end of the double main nearest the recovery plant the two mains pass into a large horizontal drum and issue as one single main of larger diameter beyond. Before entering this drum each main is fitted with a crown valve of full area, so that the gas can be entirely shut off from either main. By this arrangement one main may be shut off and cleaned carefully throughout its entire length, without for a moment stopping the working of either furnaces or recoverey plant, and when the one in action requires attention the clean main can be as readily put into use again.

DUST REMOVAL.

One of the greatest difficulties in the way of dealing with blast furnace gas, and a difficulty which seems every year to grow more serious, is the question of the removal of the mechanical dust from the gas; the very fine particles of ore and coal driven over by the blowing engines and pulled forward by the suction of the exhausters. The finely divided condition of many of the ores now in use has much increased this difficulty, and it has only been partially overcome by the conversion of these finely divided ores into briquettes.

There is as yet no royal road to the removal of this dust, and the only resource that is effective is the provision of ample means of access to the mains and the regular and persistent cleaning of the green gas main and all its seal vessels and dust catchers. If this cleaning is not thoroughly attended to, and if the dust is allowed to accumulate in the bottom of the main, the area of the main is contracted, the current of gas travels more rapidly, and the dust is carried further and further forward till it comes into vessels where it does damage, and it has to be dealt with and got rid of.

In recent plants small dust-catchers are formed on the down comer from each furnace. The down comer tube being carried to the ground level and connected by a side branch into the collecting main, the lower or dead end of the down comer forms a very effective dust trap. Then where it is necessary to change the direction of a main it is better to place a dust catcher of simple form.

TAR WASHER.

It was early recognised that some form of washer was required as a first vessel through which to pass the gas before reaching the condenser. For two good reasons this washer has come to be a tar washer, that is, the washing medium is tar; first, because there is in the gas a light or sooty tar not easily washed out by water, but readily taken up by tar;

and, secondly, it is a most economical way of getting rid of the moisture in the tar formed in other portions of the plant, by passing it through this washer and exposing it to the great heat of the gas.

In fig. 1 is shown an interesting vessel from the original Coltness plant. This tar heater was, like the dust chamber, a large cylindrical vessel, 30 ft. diameter by 60 ft. high. The gas entered at the circumference near the bottom, and passed upwards through spiral passages formed by trays in the vessel. An internal tube allowed access to the top, and inside this tube a tar pipe was carried to the upper tray. The tar ran over this tray in a thin film and at the end of one circle it dropped from the edge of the tray on to the highest part of the tray immediately below; on this second tray its direction was reversed, and so on till it reached the bottom where it was beaten up into a spray by paddles mechanically driven.

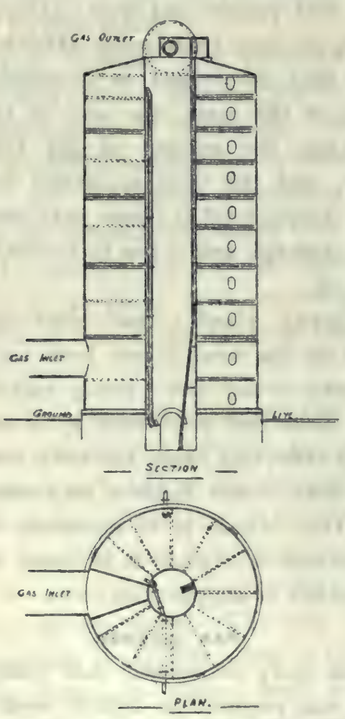


FIG. I.

The tar washer now in use in several works is made in various sizes to suit its varying amount of work. It is divided longitudinally by three vertical partitions, one of these being closed at the bottom and open at the top, and two open at the bottom but closed at the top. It is divided also by a horizontal partition plate in which there are many openings; beneath and around these openings are formed seal or baffle plates which project downwards; the openings on one side of the first partition plate do not correspond in position with those on the other side of the same partition plate. The action is this, gas passing down through these inlet openings must pass round the lower edge of the seal plate before it can issue from the outlet opening, and if the seal plate is immersed in tar the gas must wash through the tar. The greatest care must be taken that the lower edges of these seal plates are perfectly level, as any variation in level will destroy the action of the vessel, if any part has less seal than the rest, the gas seeking the line of least resistance will pour through that point in a stream of considerable depth instead of passing through below the edges in a very thin film. Formerly these seal plates were made with serrated edges as it was thought that numerous small streams were the best means of washing the gas, but if care is taken about the levels there is certainly more washing edge in the solid casting. The washer, which has been described, has a washing edge of 1,500 ft.

The tar is run away from the lowest levels at each end, and passes through a sliding pipe which can be raised or lowered to suit the seal required inside. The simpler the piping arrangements for the tar run off the better, as it is very liable to set hard and choke up everything it passes through. The tar which has been pumped into this vessel as moist raw tar is now ready for distillation and should be kept separately for supplying the tar stills. On this tar washer, all provision possible should be made for cleaning, more especially on the inlet side. At two works, at present, preparations are being made for duplicating the tar washer and an arrangement of seals which will enable either washer to be put out of action, for cleaning forms a part of the scheme.

CONDENSERS.

The final cooling of the gases has been done by atmospheric condensers in nearly all the Scotch works, if not in all. In the type of condenser erected in several recent works, the boxes are of the same general dimensions and are proportionate in number to the volume of gas to be dealt with. The bottom chests are of cast iron and so divided transversely as to cause the gas to ascend and descend the pairs of tubes. These tubes are made of wrought iron riveted and made tight with insertion of tape at the joints. The condenser as a whole is bound together at the top by a system of angle and tee steel bars, which, besides acting as binders, form the carriers for a platform round all the tubes for convenient access to the water spray cocks.

At one time seals and baffles were introduced at the inlet and outlet of each chest, as a means of isolating any chest or chests for repairs, but these baffles were abandoned as they formed an inconvenient receptacle for dust and tar, and became an added anxiety to the ammonia works manager with little or no service. Again another idea was introduced by placing butterfly valves at the inlets and so directing the currents of gas through the condensers that each chest should do as much work as its neighbours. It was found that the vagaries of the gas in choosing certain lines of travel and in changing these lines of travel through chests and tubes were as endless and as unaccountable as the changes of the weather in the West of Scotland. The butterfly valves are, I think, a thing of the past.

In nearly all these atmospheric condensers an arrangement for spraying water over the tubes is added. It is a disputed point whether the water should be sprayed directly on to the tube, or whether it is as effective to allow the water to fall in a shower between the tubes so creating a movement in the air among them. There is no doubt that movement of the air is an effective assistance in the cooling, as the efficiency of a condenser is much greater on a breezy day of moderate temperature than on a still day of comparatively low temperature.

To arrive at a proper amount of cooling surface for such a condenser is a matter of difficulty. The area that would be sufficient in an exposed situation would not be at all adequate for a sheltered site surrounded with public works. Difference in site makes great difference in the efficiency of an atmospheric condenser. Again an important factor in the estimate of size is the amount of moisture in the coal and ore, which is converted into steam and requires condensation. It is wise policy after all considerations, to keep the condenser of ample size. A very rough approximate is to allow two chests for every furnace, each chest consisting of 16 or 18 pairs of tubes 54 ft. high. In the condenser at Coltness Iron Works there are over 6¼ miles of 20-in. vertical pipes.

From each chest the tar is drained away at one end, the lower part of the box being common throughout, the divisions only filling part of the cross section of the box. The tar from the various sections is run into one common pipe, and into a separator where, by means of baffle plates and sliding valves, the tars of two densities and the liquor are separated out, the one from the other. The greater bulk of the tar from the condenser is heavy and sinks below the liquor in separation.

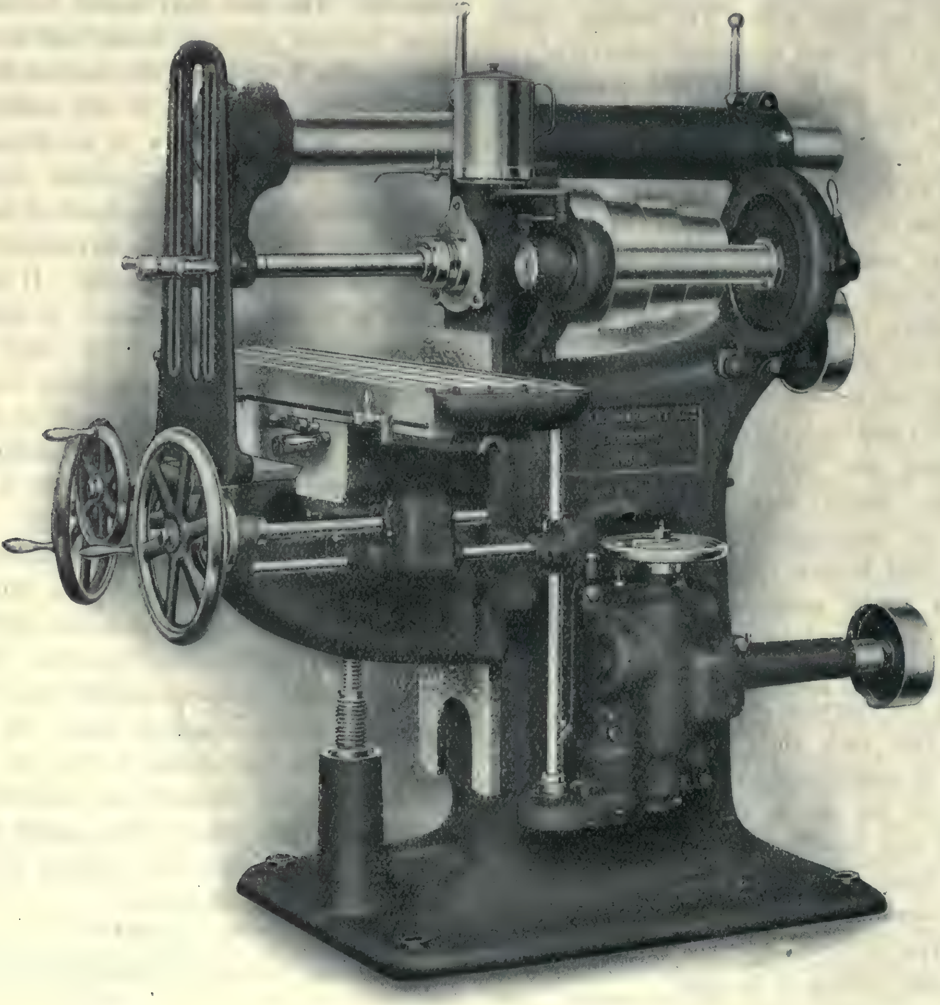
(*To be continued.*)

Abstract of a paper read before the West of Scotland Iron and Steel Institute.

A NEW HORIZONTAL MILLING MACHINE.

We illustrate herewith a new plain milling machine which has recently been brought out by Messrs. Alfred Herbert, Ltd., Coventry. The illustration gives a good idea of the general appearance of the machine, and it will be noticed that in the main it conforms to the generally accepted practice. A considerable amount of attention has, however, been given to the easy manipulation of the machine on the part of the operator, and to the completeness of the feed range. The leading dimensions are as follows: Longitudinal feed, 34 in.; cross movement, 9 in.; vertical adjustment, 20 in.

The overhanging arm is a solid steel bar of large diameter. The arm brace is a single casting, rendering it very rigid. The spindle has a long conical bearing in front and an adjustable parallel bearing behind, and may be adjusted for diameter or thrust independently.



NEW HORIZONTAL MILLING MACHINE BY MESSRS. ALFRED HERBERT, LTD., COVENTRY.

The table is exceptionally deep and is lubricated from the front, so that it is not necessary to remove the vice or other fixture when the table requires oiling.

The table is fed by a screw which does not rotate, is not splined, and is always in tension. The movements of the table, cross-slide and knee are controlled by three handwheels all within easy reach of the operator without moving from the working position. The handwheel on the right moves the table longitudinally, and by means of gearing gives a very fast travel. The handwheel in the middle is for the cross adjustments, and that on the left-hand side for the vertical adjustments. All these movements are provided with graduated dials reading to ·001 in. The elevating screw is telescopic, so that it is not necessary to cut a hole in the floor.

The firm's new patent dial feed motion by which the change from any one feed to another is obtained by simply turning the handwheel is fitted to this machine. On a disc attached to the handwheel are stamped the various feeds, to obtain any one of which it is merely necessary to turn the disc round until that feed is opposite a pointer.

The feed is arranged so that it may be driven from the spindle or direct from the countershaft, and the disc is stamped with two sets of feed-ranges, when driven from the spindle in inches per revolution, and when driven from the countershaft in inches per minute. When the feed is driven from the spindle the driving pulley is geared to revolve twice the spindle speed, so that the feed belt which is very wide has a high velocity. Messrs. Herbert recommend the feed of all milling machines to be driven direct from the countershaft, and follow this practice in their own works, where they have some 50 machines, both horizontal and vertical, in operation. It will be noticed that there are no telescopic shafts or universal joints used in the feed transmission gearing.

The knee is a box casting entirely closed in on the underside and having a bearing on the column carried up above the horizontal surface of the knee. This form of knee, although more expensive to machine, is more rigidly supported than where the bearing on the column finishes below the horizontal surface. The cross-slide is unusually long forming a very efficient support to the table.

The whole design of the machine bears witness to careful thought and is pleasing in its effect. Three sizes of this machine, including a smaller and a larger one, are at present being built; the method of manufacture is on strictly modern lines, all machine work being done to jigs and templates, and all cylindrical work that fits being finished on dead centres by grinding.

From April 1st the letter-postage to Australia will be reduced to one penny per half-ounce, and from the same date, the postage from Australia to the United Kingdom will be reduced to twopence per half-ounce.

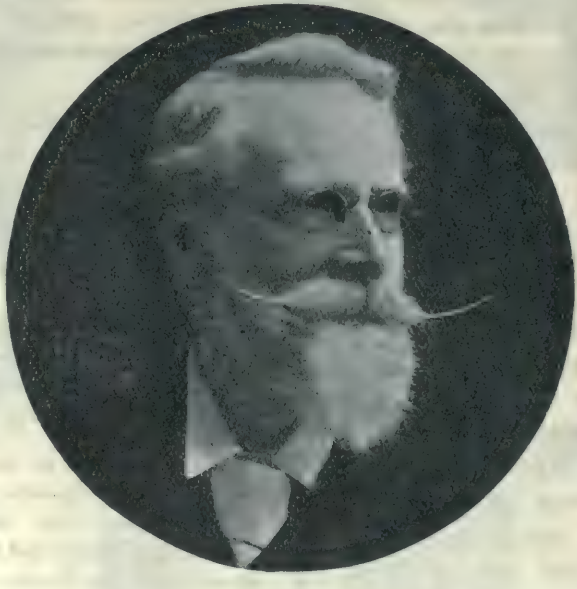
Messrs. Vickers, Sons and Maxim are considering an important scheme, having for its object the education of their apprentices. In future all apprentices in the engineering and ordnance departments will have to pass examinations in algebra, geometry, reading, writing, and arithmetic. Apprentices are to be advised to attend technical schools, and any successes gained will carry increased wages and a later hour for starting work in the mornings. Promotion to the drawing office is contingent upon attendance at technical schools. The scheme will cost £900 a year.

At the meeting of the Institution of Electrical Engineers last Thursday, Mr. Alexander Siemens announced that the McMillan Memorial Fund, amounting to £2,082, had now been invested in trustee securities for the benefit of Mrs. McMillan and her children. The trustees appointed by the Council are Sir William Preece (Vice-President), Mr. R. Kaye Gray (Vice-President), and Mr. Siemens himself. The President said that Mrs. McMillan, finding it impossible to thank individual subscribers, desired to say that she hoped that the members would accept her thanks, expressed through him, for their kindness in the matter.

OUR WEEKLY BIOGRAPHY.

SIR WILLIAM CROOKES, F.R.S., D.Sc.

PROMINENT among the names of the scientists of the Victorian era who still continue to take an active part in the scientific progress of to-day, is that of Sir William Crookes, whose career is inseparably associated with many discoveries of far-reaching importance. Born in London, June 17th, 1832, at the age of sixteen he entered the Royal College of Chemistry as a pupil to Dr. Hofmann, and in 1849 he gained the Ashburton scholarship. The following year he became his instructor's assistant, and in 1854 he was appointed superintendent of the meteorological department of the Radcliffe Observatory at Oxford—a post which he eventually relinquished in order to devote himself exclusively to the study of chemistry.



SIR WILLIAM CROOKES, F.R.S., D.SC.

He was elected a Fellow of the Chemical Society in 1857, and two years later he founded the "Chemical News," of which journal he is the proprietor and editor. In 1861 he discovered a new metallic element which he called thallium; the following year the first piece of this metal was shown at the great exhibition in London. The next eight years were mainly devoted to the elucidation of the chemical properties of the new element. The results of his investigations were communicated to the Royal Society, of which he was made a Fellow in 1863, and later he received the royal medal for this discovery, and for his investigations on repulsion resulting from radiation. In 1875 his observations of the anomalous action of the weighing of thallium compounds in highly rarefied atmospheres resulted in the invention of the radiometer; the same year he was elected vice-president of the Chemical Society.

Sir William Crookes has upon three occasions had the honour of delivering the Bakerian lectures before the Royal Society; before the British Association he gave a lecture on "Radiant Matter," in which were embodied the results of his researches on the electric discharge in high vacua. The French Academie des Sciences in 1880 awarded him a gold medal and a premium of 3,000 francs in recognition of his discoveries in molecular physics and radiant matter. He acted as a juror in 1881 at the International Exhibition of Electricity held in Paris, and although his official position precluded his obtaining an award, the report of his fellow jurors, after considering, the merits of four systems of incandescent lamps, stated that none of them would have been successful except for the extreme vacua which Sir William Crookes had shown how to manipulate.

In 1885, for his improvements in apparatus for the production of high vacua, and for his invention of the radiometer, the Society of Arts awarded him the Ferguson medal. The next year he was elected president of the B. Section of the British Association and vice-president of the Society of Telegraph Engineers and Electricians. In 1888 he received the Davy medal from the Royal Society, and in 1887 and 1888 occupied the presidential chair of the Chemical Society, when he further expounded the theory advanced at the Birmingham meeting of the British Association on the genesis of so-called elements by a process of evolution from a primordial matter or "protyle." Many of the views then set forth by Sir William and experimentally demonstrated by him a year later, are now—as recent developments prove—generally adopted by the scientific world.

As will be remembered, Sir William Crookes is the inventor of the Crookes tube which was employed by Professor Röntgen for the discovery of X-rays; he is responsible for the discovery of the sodium amalgamation process of separating gold and silver from their respective ores; he is also interested in the manufacture of beet sugar, in dyeing and calico printing, and the derivations of anthracene, while on sewage problems and artificial fertilisation he is regarded as a foremost authority.

In recognition of the eminent services he had rendered to the advancement of scientific knowledge, in 1897 the late Queen bestowed upon him the honour of knighthood. He was president of the British Association in 1898; his address on that occasion dealt with the artificial fixation of atmospheric nitrogen and its application to the soil in order to increase the production of wheat. In view of the fact than many of his researches had proven advantageous to arts and manufactures, the Society of Arts, in 1899, bestowed upon him the Albert medal. The following year he added the spinthariscope to his list of discoveries, and was appointed honorary secretary of the Royal Institution. Last year he was the recipient of the Copley medal from the Royal Society.

In addition to editing a number of well-known books, Sir William Crookes is the author of several authoritative works, the divergent nature of which demonstrates the wide comprehensiveness of his scholastic attainments.

LAUNCHES.

Messrs. Doxford and Sons, Ltd., of Pallion, have successfully launched another large twelve-masted turret steamer, the ss. *Torrington*, built to the order of Messrs. W. J. Tatem and Co., Cardiff. The vessel is a duplicate of the ss. *Wellington*, which left the berths a month ago. The length of the *Torrington* is 390 ft., the breadth 55 ft., and the moulded depth 30 ft. Ten large winches are provided for rapidly dealing with the 9,000 tons of cargo carried, and an exceptional arrangement of six pairs of side masts will further greatly facilitate the loading and disdischarging with resultant economy in dock dues, etc. The engines and boilers are supplied by Messrs. Doxford.

On Wednesday, the 22nd inst., there was launched from the yard of the Tyne Iron Shipbuilding Company, Ltd., of Willington Quay-on-Tyne, the steel screw steamer built to the order of Wilh. Wilhelmsen, Esq., of Orsnoes, pr Tonsberg, Norway, and of the following dimensions: length, 355 ft.; breadth, 50 ft.; depth, moulded, 30 ft. 6 in., and to class 100 A1 at Lloyd's on the spar-decked rule. The engines, which are to be supplied by Messrs. Blair and Co., Ltd., of Stockton-on-Tees, are of the triple-expansion type, having cylinders 25 in., 42 in., and 68 in., by 45 in. stroke, and working at a pressure of 180 lb.

Messrs. William Gray and Co., Ltd., launched, on Wednesday, March 22nd, the large steel screw steamer *Gorgistan*, built for Messrs. Frank C. Strick and Co., Ltd., of Swansea and London. The vessel will take the highest class in Lloyd's, and is of the following dimensions, viz., length over all 384 ft. 6 in., breadth 50 ft. and depth 30 ft. The vessel has a cellular double bottom and after peak tank for water ballast, and in addition there is a deep tank or hold compartment fitted for water ballast abaft the engine-room, giving a total capacity for water ballast of about 2,000 tons. The decks are of steel and iron, and all weather decks, except in wells, are sheathed with teak, and the whole of the outfit, including steam windlass, steam steering gear, ten steam winches with return exhaust to winch condenser, and marine type donkey boiler, are of the most approved description. Porter's patent derrick sockets are fitted for dealing with heavy lifts. The machinery is made by the central marine engine works of the builders', being of the triple expansion type, with cylinders 28 in., 46 in., and 77 in., with a piston stroke of 48 in. She is fitted with Weir's feed-pump and heater and two large steel multitubular boilers working by Howden's forced draught at a pressure of 180 lb. per square inch.

AMERICAN LOCOMOTIVE CONSTRUCTION.

TENDENCIES IN MODERN PRACTICE.

THE AMERICAN LOCOMOTIVE OF TO-DAY.

THE loading gauge of American railways permits of the use of rolling stock of large size; the extreme width is often more than 10 ft., and the extreme height of the chimneys of some engines is over 15 ft. The weight of rolling stock of this kind is naturally considerable.

Helped by the possession of a loading gauge of such dimensions, and being able to find work for a great many very big locomotives both in goods and passenger traffic, the American designers show in their work the most striking example of the modern tendency towards building engines of size and power as great as are compatible with the nature of the lines over which they are to run. Big modern engines with their tenders frequently weigh in working order as much as 150 tons; this weight, spread over a total wheel-base of about 60 ft. is by no means small, but when the weights put upon the driving and coupled wheels are considered, the figures are much more striking. Eight coupled goods engines have as much as 90 tons upon the coupled wheels, extending over a wheel base of no more that 17 ft., and some four-coupled express engines have 27 tons upon the driving wheels and 25 tons upon the coupled wheels. The power of the boiler is commensurate with the weight of the engine, the grate area being often more than 50 square feet, and the total heating surface between 3,000 and 4,000 square feet.

FIREBOX CONSTRUCTION.

In order to get so large a grate area it is necessary to make the firebox very wide; it is therefore spread out above the frames and wheels. With grates up to about 6 ft. wide there is still room to construct a cab of the ordinary pattern, from which the driver can get a sufficiently good view of the line in front of him. Sometimes grates much wider than this are used, and it is then necessary to put a cab for the driver on the barrel of the boiler, while the fireman occupies the usual position. This involves separating the men—a most undesirable arrangement—and this construction is therefore not much favoured. As the grate has to be above the trailing wheels the firebox must be made shallow, and there is often no room for a brick arch, or any arrangement of that nature. The back of the firebox often slants backwards from top to bottom, to enable the fireman to deal more easily with a long grate. Both firebox and firebox shell are usually round topped; Belpaire fireboxes are largely used by the Pennsylvania Railway only. The round-topped arrangement facilitates the removal of scale and dirt when the boiler is washed out. Fireboxes are invariably made of steel; if the sheets are bent to a sufficiently large radius at the angles, they appear to give little trouble by cracking and will last two years in ordinary work before requiring heavy repairs. The stays are pitched at about 4 in. spaces.

BOILERS, ETC.

The centre line of the boiler is frequently as much as 9 ft. 6 in. above the rails. The barrel of the boiler is made of two, three, or four steel plates riveted one inside the other, the one nearer the smoke box inside, the one further away from it; one of the barrel plates is usually taper, and the firebox shell is usually taper also. The largest internal diameter of the boiler barrel is sometimes more than 7 ft. The tubes, also of steel, are, as a rule, 2 in. in diameter, except when they are very long—18 ft. to 20 ft.—when they are generally 2¼ in. in diameter. At the firebox end the tubes are fixed into the tubeplate by copper ferrules being interposed between tube and tubeplate, after which the tubes are expanded in the usual way. There is a dome a short distance in front of the firebox. The safety valves are usually placed above the firebox; they are generally set to blow off at about 200 lb. per square inch in simple engines, and sometimes at as much as 225 lb. in compound engines.

The frames are composed of a series of more or less parallel bars of rectangular section, arranged one above the other and joined together at intervals to secure sufficient stiffness. The cylinders are placed outside the frames (in some new compound engines there are inside cylinders as well). Their centre line is generally an inch or two above the centre of the driving wheels. The slide valves are usually of the balanced type, placed above the cylinders and worked through rocking levers from valve gear of the Stephenson pattern. Piston valves are also used to a certain extent, generally with interior admission; they seem to give satisfactory results without any special arrangements being made to allow of the release of water trapped in the cylinders. All the weight of the revolving parts and about two-thirds of the weight of reciprocating parts is usually balanced by revolving weights in the driving and coupled wheels. Some designers calculate the proportion of the weight of the reciprocating parts to be balanced by deducting a certain part of the total weight of the engine from the weight of these parts and then balancing the rest. A certain proportion of the balance weight is put in each of the driving and coupled wheels, but a greater proportion in the former than in the latter.

COMPOUNDING.

The great majority of engines are simple, but various types of both two and four-cylinder compound engines are in use. Two-cylinder compound engines are not much more complicated than simple engines; they are probably a little more expensive to build, and a little more troublesome to work, and superior economy in fuel is practically the only advantage aimed at in using them. Four-cylinder compound engines, however, are different, and, if the cylinders and motion are suitably arranged, they have, besides the advantages of economy the further advantage of imposing a much less severe strain on the road than two-cylinder engines with the same weight upon the driving wheels.

With the American four-cylinder designs, till quite recently, the two cylinders on either side were always placed one behind the other, or one below the other, and, in either case the high-pressure and low-pressure pistons on the same side of the engine moved in the same direction at the same time. If the high-pressure and low-pressure pistons on the same side move in the same direction at the same time, they do not balance each other, and, as with four cylinders, the weight of the reciprocating parts is greater than with the two-cylinders, the disturbing force due to the motion of these parts is, in comparison with a two-cylinder engine, increased instead of diminshed; the American designers, clinging to simplicity, did not for a long time try to secure what is probably the chief advantage of the four-cylinder system. Quite lately, however, four-cylinder compound engines have been introduced with one pair of outside and one pair of inside cylinders, the two sets of reciprocating parts on either side of the engine being made approximately to balance one another by the cranks being set at 180 deg. There are various designs of engine embodying this idea; one of them (built on the de Glehn system, and almost precisely like the latest engine on the Paris-Orleans line) has been imported from France. The indications are that these engines will prove successful. Equalising levers are employed generally in connection with the springs of all the wheels.

The smoke-box is cylindrical, and of considerable length. For the purpose of preventing the throwing of sparks, there is in it a baffle-plate, fixed obliquely in front of the tubes, against which the sparks strike, and there is also a wire netting to fill up the space between the baffle-plate and the front end of the smoke-box. The blast pipe is often double, the exhaust from each cylinder escaping by a separate nozzle, but lately the practice has come in of using the blast-pipe, with a single nozzle, the advantage of which is that it can be set perfectly central to the chimney. The blast-pipe orifice is not variable. A single-nozzle blast-pipe for an express engine, with 21-in. cylinders and 50 square feet of grate, would, under ordinary circumstances, be given an orifice about 5¾ in. in diameter.

The cab is very big, but the fire-box often takes up so much space inside it that there is not a great deal of room left. The driver has a seat on the right-hand side; the handle of the pull-out regulator is within easy reach, and the reversing level is close by him, so he can remain seated the whole time.

RECENT IMPROVEMENTS.

Except shunting engines, practically all engines have either a leading bogie or a leading radial axle. The bogie is generally of the swing-link type, but lately some have been built with the side-play, controlled by means of springs, with which arrangement it is considered that the front end of the engine is less free to swing from side to side. The driving wheels of four-coupled express engines are generally between 6 ft. 6 in. and 7 ft. in diameter, of goods engines about 5 ft. The commonest type of passenger engine has a leading bogie and four wheels coupled behind, more than a quarter of the total number of engines in the country being of this design. Of late, in order to be able to get in a bigger grate, many four-coupled express engines have been built with ten wheels, a small pair of trailing wheels being added under the footplate; engines of this design are sometimes fitted with an arrangement for taking some of the weight off the uncoupled wheels, and throwing it on to the coupled wheels at starting. The commonest type of goods engine has ten wheels, eight coupled behind, with a small pair of leading wheels, but there are a great many eight-wheeled six-coupled goods engines. There are also a very large number of ten-wheel engines, with a leading bogie, and six wheels coupled behind, the diameter of the coupled wheels being anything up to 6 ft. 6 in. Lately some twelve-wheel engines have been built for express work, with a leading bogie, six-coupled wheels of large diameter, and a small pair of trailing wheels. Shunting engines have four or six wheels, all coupled. Tank engines are very few in number; it seems to be thought difficult to provide a tank large enough to enable the engines to remain at work a sufficiently long time without stopping to take water. Some shunting engines are provided with tanks carrying 3,700 gallons of water. The tenders used with express engines, even when fitted with a water scoop, are built with a capacity of 5,000 gallons. As there is often room for ten tons of coal as well, the total weight of a loaded tender is frequently as much as sixty tons. The tenders almost always run on two four-wheel bogies; on those used with shunting engines the tank slopes downwards towards the back end, so that the driver may get a better view when running tender first.

A fair price for a big eight-coupled goods engine with tender complete would be £3,700, and for a big ten-wheel four-coupled express engine a little less. In regions where oil is cheap a great many engines are run with oil fuel alone. The water before being supplied to the tenders is often chemically purified.

ELECTRIC TRACTION.

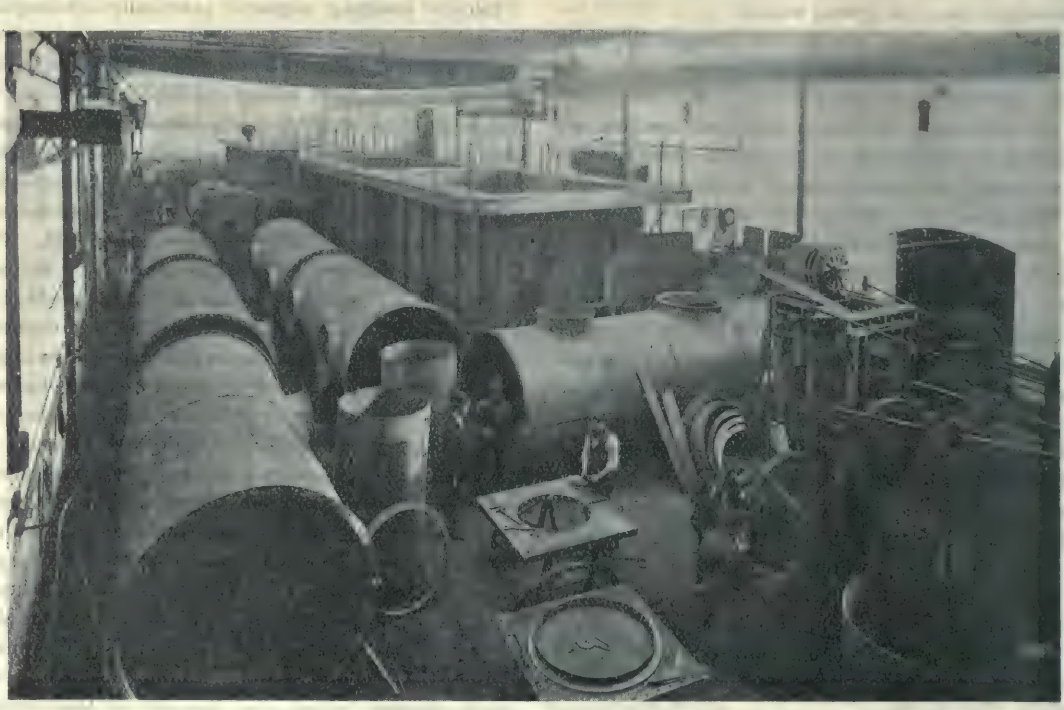
While electricity is almost exclusively used as the motive power of the extremely numerous tramways in every part of the country, on railways it is used to a very limited extent only; the overhead railways of New York and Chicago are the most conspicuous instances. For working trains through tunnels where the traffic is intense, and for suburban work in general, it is probable that electricity will be more and more used as the motive power, but the prospect of anything like a revolution in the direction of its being employed to work long distance railway traffic seems remote.

LOCOMOTIVE PERFORMANCES.

Two journeys were performed on the footplate for the purpose of making direct observations of the work of the biggest express engines: 1, with a very fast train; 2, with a very heavy train.

(To be continued.)

From a report by the Hon. Robert Collier, Third Secretary in His Majesty's Embassy at Washington.



A RANGE OF SIX DUFF PATENT TWIN GAS PRODUCERS CONSTRUCTED FOR THE DUNDERLAND IRON ORE COMPANY, LTD.

For gas firing the revolving furnaces used by the Company at their works in Norway for drying iron ore briquettes. The plant is shown in course of construction at the works of W. F. Mason, Ltd., Alma Works, Levenshulme. It will be capable of gasifying nine tons of coal per hour, and will be erected complete with elevating and conveying plant designed to deal with ten tons of coal per hour. Over each producer a storage bunker will be erected capable of holding forty tons of coal. Each producer is 23 ft. long, 11 ft. wide, and 11 ft. high. The gas tubing for conveying the gas from the producers to the furnaces, some of which is shown in the photograph, is 6 ft. 6 in. in diameter.

Temperature Experiments on Field Coils of Electrical Machines.

ENGINEERING STANDARDS COMMITTEE'S REPORT.

THIS, the latest report of the Engineering Standards Committee, is on an elaborate scale, and bespeaks great thoroughness on every page. The electrical plant committee responsible for the report is constituted as follows:—

Sir William Preece, K.C.B., chairman; Commander H. W. Richmond, R.N., Mr. C. H. Wordingham, and Mr. L. J. Steele, representing the Admiralty; Colonel H. C. L. Holden, R.A., and Captain A. H. Dumaresq, R.E., representing the War Office; Mr. A. P. Trotter, representing the Board of Trade; Mr. J. Gavey, C.B., representing the Post Office; Dr. R. T. Glazebrook, representing the National Physical Laboratory; Colonel R. E. B. Crompton, C.B.; Major Philip Cardew, R.E. (ret.); and Messrs. W. A. Chamen, Philip Dawson, S. Z. de Ferranti, Robert Kaye Gray, Mark Robinson, R. Percy Sellon, Alexander Siemens, John F. C. Snell, Charles P. Sparks, and James Swinburne; Mr. Leslie S. Robertson, M.Inst.C.E., is of course, the secretary; the electrical assistant secretary being C. le Maistre, A.M.Inst.E.E

In the standardisation of electrical machinery, the permissible temperature rise is one of the most important points to be decided, and the Generator Sub-Committee (Colonel R. E. Crompton, C.B., chairman), who have this matter under consideration, felt that no recommendation upon this particular subject could be arrived at until reliable experimental data had been obtained. It was decided to request the National Physical Laboratory to undertake this investigation, and the Sub-Committee on Physical Standards was formed to assist and consult with Dr. Glazebrook. It is confidently hoped that the results of these experiments, which, through the courtesy of the manufacturers, the committee have been enabled to carry out, will prove of material assistance in bringing to a successful issue the committee's deliberations with regard to the temperature rise to be recommended in electrical machinery.

The Committee tender their thanks to the director of the National Physical Laboratory, to Mr. E. H. Rayner, who carried out the experimental work under Dr. Glazebrook's direction, and to the staffs of the various manufacturers for their practical assistance during the actual running of the tests. Thanks are also tendered to the following manufacturers: Messrs. The British Electric Transformer Co., Ltd., the British Thomson-Houston Co., Ltd., the British Westinghouse Electric and Manufacturing Co., Ltd., Bruce, Peebles and Co., Ltd., Crompton and Co., Ltd., Dick, Kerr and Co., Ltd., Johnson and Phillips, Mather and Platt, Ltd., Siemens Bros. and Co., Ltd., and Willans and Robinson, Ltd., for their kind co-operation in building the test coils, and so furthering the work of the committee.

OBJECT OF THE EXPERIMENTS.

The main object of the experiments has been to determine generally the relation between the maximum temperature in the interior of any coil, taken by means of a thermo-junction, and the mean temperature of the same coil taken by rise in resistance. The determination of the mean temperature of any coil is a comparatively easy matter, it may be quite accurately obtained from the increase of resistance of the copper composing the winding. It is, of course, quite obvious that the outside of the winding must be at a lower and that part of the inside must be at a higher temperature than the mean.

The highest temperature and the corresponding mean temperature have been determined for the committee from experiments carried out on field coils of various sizes kindly made by different manufacturers, under actual running conditions, and also at the National Physical Laboratory. A paper entitled, "The Rise of Temperature in the Field Coils of Dynamos," by E. Brown, M.Sc. (Proceedings of the Institution of Electrical Engineers, 1901, Part 152, Vol. XXX.), was consulted, and, although the field coils experimented upon were those of a small two-pole machine, the diagrams there given were of considerable assistance and served as a basis for determining the probable position at which the highest temperature might be expected to occur.

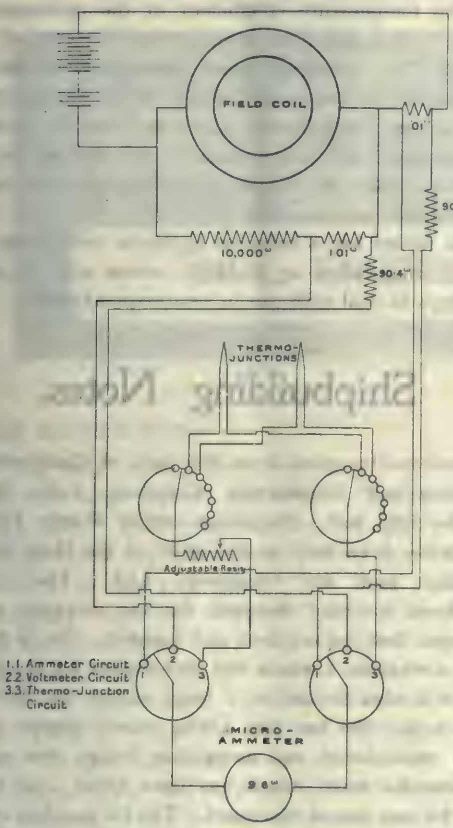
THERMO-JUNCTIONS.

A thermo-junction of iron-eureka was employed in measuring the temperature, as this combination has a high thermo-electric voltage which is very fairly linear over the range required. The thermo-junction

	1 Coil No.	2 Test No.	3 Res. Cold in ohms. 0°C.	4 Res. Hot in ohms	5 Nominal Amps.	6 Amps. during Test	7 Standing or R. p m. if Running.	8 Amps. per square inch.	9 Amps. per square m/m.	10 Watts.	11 Watts per square inch.	12 Watts per square c/m.	13 Watts per cubic inch.	14 Air Temp. °C	15 Temp. on Coil by Thermometer °C	16 Max internal Temp. °C.	17 Mean Temp. °C	18 Max. minus Mean. °C	19 Max. minus Air Temp. °C.	20 Max. – Air Temp. / Watts per sq. in.	21 Mean minus Air Temp. °C.	22 Mean – Air. Temp. / Watts per sq. in.	Page.
2	1α	1α B	79·5	109·4	1·0	1·0	S.	800	1 25	110	·380	·059	·390	12	53·0	105·3	88	**17·3**	93·3	246	76	200	6
3	1β	1β A	61·6	85·50	1·3	1·29	R. Light 850	850	1·32	142	·490	·076	·508	13	50·5	106·0	90 5	**15·5**	93·0	190	77 5	158	7
4	1γ	1γ B	6·43	9·25	—	3·72	S	915	1·42	128	·442	·068	·460	18	74·5	115·0	101·6	**13·4**	97·0	220	83·6	190	8
5	,,	1γ C	,,	8·91	—	3·47	,,	850	1·32	107	·368	·057	·380	18	67·3	102·2	89·5	**12·7**	84·2	228	71·5	194	,,
6	,,	1γ D	,,	8·51	—	3·16	,,	780	1·21	86	·296	·046	·310	17	57·0	85·8	78·5	**7·3**	68·8	232	61·5	208	,,
7	,,	1γ E	,,	8·33	—	2·90	,,	710	1·10	70·4	·242	·038	·250	16	50·4	74·3	68·5	**5·8**	58·3	242	52·5	216	,,
8	,,	1γ F	,,	8·56	—	3·66	S. no core	900	1 40	115	·400	·061	·410	13·6	57·0	93·6	77·2	**16·4**	80·0	200	63·6	160	,,
9	1δ	1δ F	6·35	8·00	—	3·66	,,	900	1·40	107	·370	·057	·380	13·6	49·0	68·5	60·5	**8·0**	54·9	150	46·9	127	,,
10	2	2A	15·31	22·2	4·0	4·3	R. at F.L. 325	980	1·51	407	·680	·105	·473	21	55·0	126·5	105	**21·5**	105·5	155	84	124	9
11	,,	2B	,,	21·6	,,	,,	R. Light 310	980	1·51	400	·667	·103	·465	21	53·0	116	96	**20·0**	95·0	142	75	112	,,
12	,,	2C	,,	22·15	,,	3·32	S. core used.	755	1·17	244	·406	·063	·284	15	81·0	121·4	104·2	**17·2**	106·4	262	89·2	219	,,
13	3	3A	31·5	41·0	2·0	2·0	R. at F.L. 600	1,100 945	1·71 1·45	164	·342	·053	·310	21	44·0	93·8	70·3	**23·5**	72·8	212	49·3	144	10
14	,,	3B	,,	41·2	,,	1 68	S. core used.	780	1·21	115	·240	·037	·217	12	49·0	92·6	71·8	**20·8**	80·6	335	59·8	250	,,
15	4	4A	35·2	52·2	1·7	1·52 varying.	R. at F.L. 265-360	840	1·30	120	354	·055	·240	27	69·0	110·3	107	**3·3**	83·3	235	80	226	10
16	,,	4B	,,	49·2	,,	1·54 varying.	,,	850	1·32	120	·354	·055	·240	30	75·0	96·8	92·7	**4·1**	66 8	188	62·7	177	,,
17	,,	4C	,,	50·7	,,	1·72	S. no core.	950	1·47	150	·440	·068	·300	19	59·0	106·8	103	**3·8**	87·8	200	84	191	,,
18	5	5A	3·81	4 78	,,	9·2 varying.	R.L.V. 180	650	1·01	400	·308	·048	·182	19	41·0	67·0	59·5	**7·5**	48·0	156	40 5	132	11
19	6	6A	2·70	3 21	11·4	7 07	R.L.V. 340	350	0·55	161	·124	·019	·070	24	31·0	46·4	44·0	**2·4**	22·4	180	20	161	11
20	,,	6B	,,	3·28	,,	7·09	S. coil on Machine.	350	0·55	165	·127	·020	·072	20	41·0	52·3	50·2	**2·1**	32 3	254	30·2	238	,,
21	,,	6C	,,	3·77	,,	11·12	S. no core.	555	0·86	467	·360	·056	·203	23	64·0	100·5	92·5	**8·0**	77·5	214	69 5	193	,,
22	7	7A	6·70	8 95	6·5	5·2	R. as Motor 108	640	0·98	238	192	·030	·162	12	47 0 on series.	88 1	78 5	**9·6**	76·1	400	66 5	346	11
23	,,	7B	,,	8 48	,,	,,	S core used.	640	0·98	230	185	·029	152	12	41·0	78·4	62·0	**16·4**	66·4	360	50 0	270	12
24	,,	7C	,,	9·7	,,	6 54	,,	800	1·23	415	335	·052	·282	15	64 0	126 2	104·5	**21·7**	111 2	330	89 5	267	,,
25	8	8A	4·98	6·82	8·0	8·20	R. at F.L. 320	805	1·25	458	·380	·059	·260	26	31 0	102	86·0	**16·0**	76 0	200	60	158	12
26	,,	8B	,,	8·10	,,	11·1	,,	1,090	1·69	995	830	·128	·562	26	57·0	180	144	**36·0**	154 0	186	118	142	,,
27	,,	8C	,,	7·41	,,	8·12	S core used.	795	1·23	488	·406	·063	·275	12	54·0	135·4	113	**22·4**	123·4	304	101	249	,,
28	,,	8D	,,	7·25	,,	7·60	,,	745	1·15	420	·350	·054	·237	19	51 0	131 6	106 3	**25·3**	112·6	320	87·3	249	,,
29	9	9A	·688	874	14·5	19	R. Light 200	585	·91	315	274	·042	·210	20	45 0	65·4	63·2	**2·2**	45·4	165	43 2	157	12
30	,,	9B	,,	·818	,,	,,	,,	,,	,,	295	·256	·040	·197	18·5	40·0	45·7	44·0	**1·7**	27·2	106	25·5	100	13

TABLE II. FROM THE REPORT OF THE ENGINEERING STANDARDS COMMITTEE, DEALING WITH TEMPERATURE EXPERIMENTS ON FIELD COILS.

DIAGRAM OF CONNECTIONS.



EXPLANATORY NOTES TO TABLE No. 2

Column No 1. Coil number
" 2. Test number
" 3. Resistance of coil cold, in ohms at 0° C.
" 4. Resistance of coil hot, in ohms.
" 5. Nominal amperes.
" 6. Amperes in coil during test.
" 7. Experiment carried out with machine running, or on coil with its core, or alone, *i.e.*,

$\frac{\text{R at F.L.}}{325}$ = Running at 325 R.p.m. at full load.

$\frac{\text{R.L.V.}}{180}$ = Running at 180 R.p.m., load varying.

$\frac{\text{R Light}}{310}$ = Running light at 310 R.p.m.

$\frac{\text{S.}}{\text{No core}}$ = Tested standing without the core.

" 8. Amperes per sq. inch
" 9. " per sq. m.m.
" 10. Watts
" 11. Watts per sq. inch
" 12. " " sq. c.m.
" 13. " " cubic inch
" 14. Temperature of air during test in °C.
" 15. Temperature on coil by thermometer in °C.
" 16. Maximum internal temperature °C.
" 17. Mean temperature in °C. calculated from the formula $R_\theta = R_0 (1 + \cdot 00428\theta)$
" 18. Maximum minus mean temperature
" 19. Maximum minus air temperature
" 20. $\frac{\text{Max.}-\text{Air temp.}}{\text{Watts per sq. inch}}$
" 21. Mean minus air temperature
" 22. $\frac{\text{Mean}-\text{Air temp.}}{\text{Watts per sq. inch}}$

In all cases temperatures given are actual temperatures in degrees Centigrade, and only where stated do the figures represent temperature rise.

The figures given in Columns 20 and 22 are inversely proportional to the emissivity.

consisted of No. 26 S.W.G., double silk-covered wires, silver soldered at the ends and bound together with silk, making a very compact and flexible arrangement for measuring temperature at a point.

GALVANOMETER EMPLOYED.

The actual reading of the temperature was recorded on an extremely sensitive moving-coil galvanometer made by R. W. Paul. This instrument was designed with a particular resistance and sensitiveness suitable to the special conditions under which it was to be employed. The highest reading on the scale was 0·0002 ampere and less than 0·002 volt. By the addition of a variable resistance in the thermo-junction circuit the instrument was calibrated to read direct in degress C., *i.e.*, the difference in temperature between the "hot" and "cold" thermo-junctions.

DESCRIPTION OF APPARATUS.

The "cold" junction was placed inside a box with fifteen pairs of terminals which at the same time was used as a multiple switch for the various thermo-junction circuits. A thermometer in the box gave the temperature of this cold thermo-junction and this, added to the deflection on the galvanometer gave the temperature in degrees C. The exact value of the resistance to be put in circuit to give direct readings in degrees C. was determined by heating a sample thermo-junction in an oil bath with a thermometer, and in this manner the accuracy of the readings has been frequently checked. Various resistances have been specially made to suit the galvanometer, in order to be able to measure the volts and amperes in the coil under test, which was, of course, requisite for calculating the mean temperature of the coil at any time. A three-way switch was used, by means of which the thermo-junction—, the volt—, or ampere—circuits could be connected to the galvanometer. Besides this, resistances were arranged in the box so as to measure the resistance of the field coils cold, at a definite temperature, by a bridge method, thus avoiding the use of a large current and consequent errors due to the heating effect during observation.

Special precautions were exercised to ensure equality of temperature in the coil when measuring the "cold" resistance, as on this figure the calculations for the mean temperature were based. In some cases it was even found necessary to cover the coil with a blanket for two or three days before concordant figures could be obtained. Care was also taken in arranging the resistances so that the galvanometer could be calibrated by an ordinary potentiometer.

This arrangement for reading the temperature, the amperes and the volts on the same instrument has been of great assistance, especially in the experiments conducted at the works of the various manufacturers supplying the coils. The sensitiveness of this instrument has very largely contributed to the accuracy and ease with which the results have been obtained.

A diagram of connections is reproduced showing the method adopted in carrying out the investigation. The apparatus was ready for use by simply moving the multiple switch to read (for instance : at the 100th division in the centre of the scale) 100 volts, or 1·0 ampere, or 100 deg. C. above the atmospheric temperature. The various other resistances were employed for giving other constants as desired. The figures for the temperature have been read to 0·2 deg., and the points on any curve are in themselves of this order of accuracy, but the actual position of the whole curve is in all probability only accurate to 1 deg. on account of various secondary errors due to temperature and stray magnetic field.

The general method adopted throughout the investigation has been to carry out a preliminary test at the National Physical Laboratory on the coils after which tests were made on the coils under actual working conditions at the manufacturer's works.

The excess of the maximum over the mean temperature varied according to the shape of the coil, and the temperature at which it was run.

A considerable cooling effect on the core side was noticeable in the case of some of the coils wound on a metal former, where there was an air space between the core and the coil, and consequently some of the curves obtained show nearly as low a temperature on the core side as on the outside, when the machine was running.

DETAILS OF COILS.

Coils Nos. 3, 5, 6 were wound on metal formers and merely varnished on the outside. Coil No. 7 was wound on a metal former, but covered to a great extent by the series winding. Coils Nos. 1α, 1β, 1γ. were wound on temporary formers and finished with tape and other insulating materials. Coil No. 4: the series winding on this coil was enclosed in the taping. Coil No. 8: a layer of string was added to this coil. Coil No. 9 was wound on a metal former, protective coverings being used.

All coils, except No. 4, were wound with double cotton-covered wire, the latter being wound with single.

The figures in column No. 18 of the accompanying table give the essential results of the investigation, and it will be noticed that the figures for the difference between the maximum and the mean temperature vary from about 25 deg. C. downwards. A value of 0·428 per cent. per degree C. has been assumed for the temperature co-efficient of the resistance of copper. This has been confirmed in the case of coil No. 3. The somewhat small difference between the maximum temperature found by thermo-junction and the mean temperature, calculated from the increase of resistance, which is noticeable in a few of the experiments may be due to this co-efficient not being exactly the value assumed.

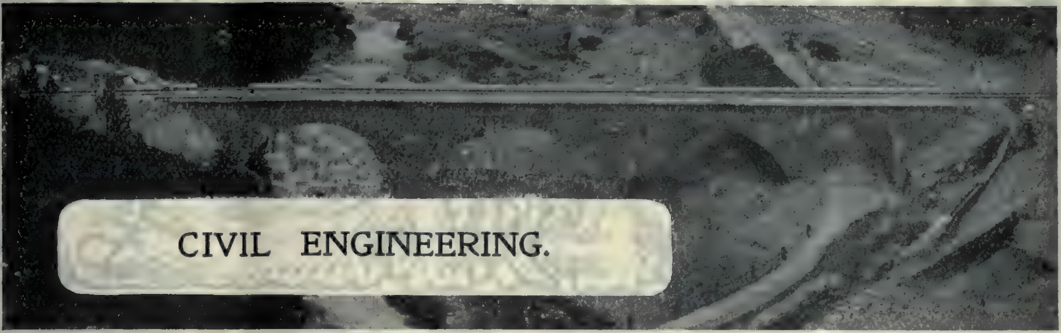
The report has a valuable appendix concerning the actual temperature up to which cotton may be used. We hope to deal with this in a subsequent issue.

Shipbuilding Notes.

THERE was launched from the yard of Earle's Shipbuilding and Engineering Company, Ltd., Hull, on the 17th inst., the steam carrier *Warter Priory*, which has been built to the order of the Hull Steam Fishing and Ice Company, Ltd. The vessel has been specially designed for the carrying trade between their fishing fleet and London. She is fitted with a whaleback which will give shelter for the crew, and will also shelter to a large extent the forward well deck. She has also a long raised quarter deck, with wheel-house and navigating bridge over same. A powerful trawl winch has been fitted, and trawgear for one side of the vessel. The ice and fish rooms are of large size, insulated throughout. The dimensions of the vessel are 146ft. 8in. by 23ft. by 11ft. 9½in., moulded. The engines and boiler will be supplied by Messrs. C. D. Holmes and Co., Hull.

Messrs. Workman, Clark and Company, Ltd., Belfast, launched from their South Yard on the 21st inst., the first of two steel-screw steamers, which are being built by them to the order of Messrs. Elders and Fyffes (Shipping), Ltd., of London. The new vessel has been named *Pacuare*, and is specially designed and equipped for the conveyance of fruit in bulk between the West Indies, Costa Rica, and this country.

The *Pacuare* is one of the largest vessels engaged in the fruit-carrying trade, being 383 ft. in length, with a gross tonnage of nearly 4,000. She has four complete steel decks, extending fore and aft, and a top-gallant forecastle. The cargo space is divided into separate compartments by steel bulkheads extending to the upper deck, all these compartments being insulated, while a complete and efficient installation of refrigerating machinery will be fitted, having air ducts to convey the cool air to each compartment for the preservation of the fruit during transit.



CIVIL ENGINEERING.

The Assouan Dam.

The daily contemporary, which a few weeks ago put into large capitals the words, "Death Blow to Arbitration" upon receiving the first garbled report of the North Sea Commission, printed in a prominent position on the 25th inst., "Nile Dam in Danger: Alarming Scientific Discovery" (!). This is what Sir Benjamin Baker has to say about the "alarming" business in question, his remarks being based upon a recent inspection: "I found that the masonry protecting the bed of the river was standing the strain well. Where the rocky river bed was not so protected the water had torn many holes—in some cases 24 ft. deep. These do not at present affect the dam, for they are 40 or 50 ft. away from it. In the course of a few years they might extend closer to the base of the dam, were the masonry protection not completed. With this mischief caused by the present head of water, it would obviously be folly to raise the dam at once, and thus increase the force of the water by raising its level. This factor alone postpones any consideration of the raising of the dam for two years. As to the 'new theory' of the stresses to which masonry dams are subjected, advanced by Professor Karl Pearson, it is not so much a discovery as a development. Professor Pearson would apply it to all masonry dams, but I am not prepared to go so far as that at present, but we are both working at it. The two years' breathing space given us by the present necessary work will enable scientific men to make up their minds as to its application to the Assouan Dam.

New Docks for Antwerp.

Great activity is being displayed over the new docks (Bassins Intercalaires), which are at present in course of construction at Antwerp, and which are to be open and ready for traffic by May, 1907. These docks will cover an area of 333,301 square yards, and will be by far the largest docks in Antwerp. They are to be constructed at a cost of £300,000, and will have access to the river by means of the Lefebvre Dock, the entrance lock being 55 yards in width. The dock is to be made in two divisions, each of which will be rectangular in form, the two converging together at the entrance into a neck 98 yards wide. In the construction of this dock part of the existing chain of fortifications which encircle the town of Antwerp will have to be demolished, and re-erected at some distance. An additional area of 319 acres will thus be enclosed within the walls of the town. These docks will have a depth of water of 30 feet, and are to be so constructed that, should it be deemed necessary, the bed of the dock can be deepened by 3 feet. The work of construction, which was put up to public tender, is being carried out by an Antwerp firm. The top of the quay wall in all these docks is 11 ft. 10 in. above the normal water level. It is interesting to note, from the consular report from which the above is taken, that Antwerp shows every sign of maintaining her position as the third largest port.

Dover Harbour.

Since my last notes the eastern and western breakwaters of the Admiralty Harbour at Dover, have been completed within three days of each other. The works have been in progress for the past five years, and details, with illustrations, appeared in PAGE'S MAGAZINE for February, 1904. The breakwaters enclose a width of about one and a half mile, comprising over 600 acres of anchorage. The southern break water, 4,200 ft. long, which is rapidly progressing will complete this great national undertaking.

Manufactures of Greater Britain.

No. I.—CANADA.

A COURSE of lectures is being delivered before the Colonial section of the Society of Arts. The first lecture was by Mr. C. F. Just on the "Dominion of Canada." The following is an abstract of the engineering portions of the lecture :—

Canada's iron industry is represented by eighteen blast furnaces and several steelmaking plants, located at nine different points in Nova Scotia, Quebec, and Ontario. Of the importance of the hundred and one subsidiary industries dependent on iron and steel, the census returns furnish conclusive evidence. Of these the engineering industry is notable for its growth during the last five years, and for its ability now to undertake large and complicated work. Many new establishments are also under construction in most of the chief centres.

The iron and steel enterprises in Ontario at the Sault Ste. Marie and in Nova Scotia, at Sydney, were initiated, and are still largely supported by American capital. The Steel Trust of the United States is known to have made large purchases of mineral lands, and has arranged to put up an immense plant at Port Colborne, Lake Erie, to employ 3,000 hands. Another American enterprise is the Canadian Steel and Coal Company, with a capital of 6,000,000 dols., possessing large properties in iron ore and coal lands. Similar support is also being given to copper mining, and to developing oil wells, asbestos, mica, and nickel deposits, and to reduction works and other metallurgical processes.

It is no secret that much of this recent American enterprise in Canada is directly due to the British preference policy. Americans fear this policy, if pressed and developed, will result in the loss to them of much of their trade with the British Empire, and that Canada, with like resources, possesses exceptional opportunities for taking the place of the United States. "Forewarned is forearmed," and so during the last few years a systematic transfer of American manufacturing to Canada has taken place for the double event—*i.e.*, Canada's home and foreign markets. Leading American firms of agricultural machinery have united to put up jointly works employing thousands of hands at Hamilton, Brantford, Stratford, and Toronto for the home and export trade; sewing machine factories in Quebec; locomotive, rolling-stock and bridge-building works at Montreal and Toronto; general engineering works for the manufacture of machinery of all kinds.

American capital also is largely invested in the new Canadian power works at Niagara, Shawinigan, the "Soo," Fort William, and at other points.

THE COAL AND IRON INDUSTRY.

The determining factor in a nation's position in the world is held to depend ultimately upon the possession of coal and iron. In these essentials to a country's welfare, and its industrial potentialities, Canada is richly supplied. It is doubtful also whether there is any other country richer in gold and silver, in lead, copper, and nickel, and in the other principal metallic and non-metallic minerals, the fuller development of which must shortly command the attention of capital. The present ascertained coal areas of the Dominion are estimated at 97,200 square miles.

The iron ores of the Dominion are unquestionably of great extent and importance. In Nova Scotia iron ore is found in workable amounts in most of the counties; for all practical purposes, however, the enormous ore reserves of Newfoundland—still politically outside the Dominion—must be included among Canadian sources of supply. The most notable are the hematite deposits on Bell Island, estimated to contain 35,000,000 tons, the property of Nova Scotia ironmasters. In Quebec extensive deposits of magnetic iron-sand exist on the north shore of the St. Lawrence river, where it is estimated that many millions of tons of ore containing a high percentage of iron, and practically free from phosphorus and sulphur could be obtained by a good process of concentration. With regard to Ontario, it is doubtful whether in any part of America so great an extent exists of rocks favourable for the occurrence of ore deposits as in Ontario. . . . . Already a number of mines have been located both of hematite and of magnetite, and it need not be surprising if within the next five or six years mines are developed in northern and north-western Ontario. Indications as tested by the diamond drill, go far to establish the fact that the great iron ranges to the south and west of Lake Superior, whence the United States iron industry derives to-day 70 per cent. of its raw material, extend across into Canada.

STEEL MAKING PLANT EQUIPMENT.

In British Columbia, ore deposits of high quality are known to exist, and have been located in large bodies within easy reach of ocean transportation. Considerable quantities of these ores are already being exported to the iron industry of the United States on the Pacific Coast in competition with native ores, despite the tariff of 40 cents. (1s. 8d.) a ton to which such importations are subject.

To-day there is a capital of 40,000,000 dols. invested in Canadian iron and steel works, and in the iron mines of the country. Successive Canadian administrations, convinced of the necessity of the industry to the national growth, have given additional encouragement in the form of bounties on the production of pig-iron and steel billets. The industry has now reached an advanced point in its formative stage, and may at any time assume the ultimate form of a great industry.

The present equipment of the Dominion consists of four coke and six charcoal smelting plants, with a total capacity of 1,000,000 tons of pig-iron per year, and of five large steel-making plants, capable of producing 500,000 tons of steel annually. The works are at Sydney, New Glasgow, Londonderry in Nova Scotia, Radnor in Quebec, and at Deseronto Hamilton, Midland, Collingwood, and Sault Ste. Marie in Ontario. Certain of these plants have had their vicissitudes, but all are now successfully adjusting their output to local needs. The annual consumption of iron and steel in Canada is estimated to-day at 850,000 tons, with every prospect of a rapid increase. Local production at present is equal to about one-third of the actual capacity of the works referred to, the balance of Canada's total requirements being imported, as to 70 per cent. from the United States, and as to 30 per cent. from the United Kingdom.

The decision of the Government in 1904 to put a protective duty on steel rails—hitherto on the free list—must lead eventually to the production within the Dominion of the greater part of its rail-requirements. These requirements, for the present mileage—20,000 miles—are estimated at 200,000 tons annually, and with the new extensions in progress and planned, must increase rapidly. The only rail-mill in operation at present is at the Canadian "Soo," with a capacity of 500 tons a day; a second mill of 1,000 tons capacity will be completed in July next at Sydney in Cape Breton on tide water, where the largest and most ambitious Canadian iron and steel plant is situated. At this point the conditions of cheap production are admitted to be unequalled on the North American continent, perhaps in the world.

LOWER COST OF RAW MATERIALS.

Sydney's advantage over Pittsburg, U.S.A., lies in the lower cost of assembling the raw materials for producing a ton of pig-iron. Again, for the export trade Sydney has an advantage over Pittsburg of 460 miles land-carriage to the sea-board, and of about 1,000 miles of ocean-carriage so far as the European market is concerned. These conditions should always prove a great factor in securing for Nova Scotia a pre eminence in the production of iron and steel. The principal centres of consumption in Canada are in Ontario, and in this province the remaining iron and steel plants of the country are to be found, one of the first magnitude being, as stated, at Sault Ste. Marie. All these plants lie at, or near, lake navigation; they are designed to meet local requirements and the demands that may arise from new industries such as the construction of lake-shipping, which is now of immediate importance in view of the enormous tonnage which Western Canada is providing for transportation in Canadian bottoms to Canadian lake and ocean ports.

The day of the iron industry in British Columbia is not yet. However, the character of the development that lies before that province on the Pacific Ocean, its growing shipping interests, the exceptionally rich local iron and coal deposits, and the distance from the iron industry of Eastern Canada all suggest the probability of early action being taken.

Probably Canada's greatest industrial asset and the best guarantee of her industrial future lies in her unequalled water-power scattered by the prodigal hand of nature throughout her vast territory. The future industrial development of Canada will undoubtedly be closely associated with the utilisation of her water falls. It is chiefly, however, in connection with electro-chemical works that Canada may look immediately for the greatest return from water-power.

These possibilities flowing from the use of water-power are not merely in the air, but are now being realised in Canada on a large scale.

TECHNICAL SOCIETY NOTES.

REFERENCE was made in the last issue of PAGE'S WEEKLY to the opinion expressed in the official abstract of Lord Brassey's paper, "Shipbuilding for the Navy," that the discussions which take place from time to time under the auspices of the Institution of Civil Engineers were valuable for the guidance of public opinion. It was pointed out that it was not easy to see how public opinion was to be guided by discussions from which pressmen are rigorously excluded. There was the more point in this criticism, because although it is pretty common knowledge that Sir William White made a long and important contribution to the debate on Lord Brassey's paper at that adjourned meeting, not even the usual brief abstract of the proceedings has been issued to the press. Sir William White's opinions on a matter of important public policy, and on which he speaks with particular authority, will therefore be enshrined in the archives of the Institution of Civil Engineers until the next volume of the Transactions makes its usual belated appearance, when what should be news has merged into the domain of history.

The discussion at the Institution of Electrical Engineers on the papers of Mr. Rayner and Mr. Goldschmidt was lively and at times even amusing. It fell to Professor S. P. Thompson to open the discussion. He said that the former paper "On the effect of heat on the electrical and mechanical properties of dielectrics," dealing with the results of experiments at the National Physical Laboratory was a most important piece of work, and that all those whose business it was to calculate the duties that could be got out of electrical machinery, would appreciate what had been done, and appreciate it more and more as time went on. It was a veritable storehouse of facts, and as it was the first important communication which the National Physical Laboratory had made to the Journal of the Institution, they would look forward with pleasurable anticipation to future papers from the same source.

Professor Thompson then turned to Mr. Goldschmidt, and after expressing his admiration for his paper on the "Temperature Distribution in the Interior of Field Coils," proceeded to criticise it piecemeal, a process which can scarcely have been so entirely appreciated by the author who was sitting beside him as it seemed to be by the meeting generally. Happily there appeared to be nothing wrong with the author's general conclusions; he merely seemed to have arrived at them by processes which do not entirely commend themselves to the purely scientific mind, and indeed, the learned Professor hinted that in the effort to avoid mathematics, the author had adopted a method of reasoning which was even more difficult to follow. On all these little matters Professor Thompson proceeded to put the author right, and as Mr. Goldschmidt subsequently expressed his thanks he clearly took the criticism in the kindly spirit in which it was intended. Mr. Goldschmidt pointed out, however, that he had deliberately adopted approximate rather than mathematical methods in order to render the application of tests more easy in workshop practice, and on the more purely theoretical side he promises another paper. Other speakers expressed their keen appreciation of Mr. Goldschmidt's paper. Mr. Goldschmidt himself had some observations to make on Mr. Rayner's paper, which completed the chain of criticism.

The general opinion expressed with regard to Mr. Rayner's paper was that it was likely to prove very valuable. Mr. Hobart said the investigation would be of considerable service to designers and that the importance of the subject treated by Dr. Glazebrook and Mr. Rayner could hardly be over-estimated. He suggested that the experiments might be carried further with a view to elucidating other points of interest. Mr. Berry found so much that was beautiful in the paper that he had had to make a search for the merely useful. He noted that Mr. Rayner recognised the limits of laboratory tests, and he would point out that while the work had been done extremely well some of the tables might prove utterly misleading if not read with very great discretion. Mr. Rayner, in his reply, insisted upon the fact that as far as possible the tests had been carried out under ordinary commercial conditions. There is a tendency one knows to make light of laboratory experiments. This is a mistaken attitude. They have a very definite value and if correctly appraised are an admirable guide to the solution of problems which arise in commercial working. And while Mr. Rayner's tests come within the category of laboratory experiments, they approximate far more closely than is usually the case to the conditions met with in practice. The experiments themselves are referred to, and the results tabulated, in another part of this issue.

LONDON ELECTRIC POWER BILL.

THE most important of the nine electric power bills proposing to supply electricity in the London district is that of the Administrative County of London and District Electric Power Company, some particulars of which have already appeared in PAGE'S WEEKLY. Briefly, the object of the promoters is to establish three generating stations on the banks of the Thames and to supply electrical energy to all the existing electric supply companies and local authorities, and to other persons requiring supply for power purposes. At the present time there are within the proposed working area of the Administrative County of London Company thirty local authorities and twenty-one companies supplying energy from sixty-two generating stations, and it is argued on behalf of the bill that by concentrating the plant in large stations the price of energy can be so reduced that large manufacturers will find it to their advantage to make use of it. It is pointed out that in the industrial area of the new company there is manufacturing machinery amounting to 450,000 h.p., of which only about 4 per cent. is supplied by existing authorities. The present generating stations have been designed, it is said, for the main purpose of carrying on a lighting business, and in fact the lighting business of the present authorities is put down at 90 per cent. of the total. The part of the bill on which attention has been focussed is that relating to prices to be charged. The maximum is not to exceed 1½d. per unit, and the moderate consumer of current for power purposes would, it is claimed, be supplied at about 0·865d. per unit, a rate which no London Company has ever offered in an industrial area before.

The existing companies are naturally opposed to this scheme, and it is alleged that the proposed competition is manifestly unfair. These companies have played the part of pioneers in London, with the result that the dividends received by shareholders average no more than 4 per cent., and they naturally resent a new concern stepping in when the outlook is improving to reap the financial benefit of their past efforts. If the promoters of the new scheme succeed in their object it is held that it would mean the creation of a huge trust with a monopoly of the electrical supply for London in its hands, a condition of affairs which would not be to the ultimate benefit of the consumer. Broadly speaking, the existing companies say that if Parliament is prepared to give the sort of powers asked for, they should be given to the existing companies. On the subject of the multiplicity of stations, it may be pointed out that the present companies are debarred by the terms of their provisional orders from intercommunicating their stations, and thus cannot enjoy the benefits of concentration. The result is that each supply company and local authority has to keep its own stock of spare plant instead of being able to keep "spares" for the whole of London, as would be the case if the generating stations were interconnected. Why a system of interconnection should be outside their powers it is a little difficult to conjecture, but possibly the fear that jointly interested companies might become too powerful led to this proviso being insisted upon, as it is obviously easier for the local authorities to deal with separate undertakings rather than with companies which by intercommunication of mains have to a certain extent common interests to defend. As a matter of fact, a policy of concentration is already in process and is claimed to have produced remarkable reductions in the cost of supply.

In the all important question of price, it is argued that the basis on which the new company is fixing its maximum price, is to a certain extent fallacious, being surrounded by reservations calculated to make it ineffective. The question of local conditions has also been raised, and doubts expressed if current could be supplied at a profit in London on the same terms as in the Newcastle district. In this connection there are several considerations which are at once suggested. On the subject of the allegation that the existing companies have not encouraged power customers, it may be mentioned that one existing company alone is supplying something in the neighbourhood of 20,000 h.p., and supplying that power for all sorts of industrial purposes. It is probably true that the actual cost of generating this power is some fraction of a penny, but to that has to be added interest on capital, depreciation of plant, and other items which make it impossible to supply the current to consumers at the minimum price suggested in the new company's bill. The system in vogue by existing companies is to charge a certain maximum price for power, and to give a progressive discount according to the number of hours used. It is recognised, indeed, that the power business is likely to prove one of the best assets of the existing companies, and if this new company were allowed to come into operation, and secure power customers in the existing areas, it would probably mean that the prices for lighting would have to be raised, as the demand for power is mainly at low lighting load. The existing companies are, it is asserted, supplying current for power at very cheap rates.

With reference to the advantages of stations of large capacity, some of the existing stations run up to 20,000 to 30,000 h.p., and it is a moot question whether that power does not realise all the economy to be obtained by a policy of concentration. This applies particularly in the London district.

It is suggested that a preferable scheme to that now proposed would be for the County Council, local authorities, and the existing companies to promote a bill asking for powers to interconnect the whole of their stations, which should give all the advantages claimed for the new scheme.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Newport (Mon.).—Construction of main outfall and branch sewers for the Western Valleys Sewerage Board. Particulars at offices of Mr. Baldwin-Latham, Parliament Mansions, Victoria Street, S.W.; Mr. Geo. Chatterton, 6, The Sanctuary, Westminster, S.W.; or Mr. T. S. Edwards, Clerk to the Board, Newport (Mon.) ... April 1

Rishworth (Yorks.)—Construction of a concrete service tank (56,000 gallons), on Rishworth Moor, including wood and slate roof, for the Rishworth Urban District Council Waterworks. Messrs. Richard Horsfall and Son, surveyors and architects, 22a, Commercial Street, Halifax April 1

Aberdeen.—Erection of new bridge of steel girders and masonry, for the Alford and Huntley District Committee. Mr. James Barron, Central Chambers, 216, Union-street, Aberdeen... ... ... April 3

Birmingham.—Supply, delivery, and erection of 200 electric tramway cars for the Tramways Committee. Mr. Alfred Baker, general manager, 254A, Corporation Street, Birmingham ... ... April 4

Rochdale.—Supply and delivery at their gasworks of two Lancashire steam boilers 30 ft. long by 8 ft. diameter, to work at a pressure of 150 lb. per square inch, for the Gas and Electricity Committee. Mr. T. Banbury Ball, Gasworks, Rochdale ... April 5

Olton and Bordesley.—Widening of a portion of the line between Olton and Bordesley, about 2¼ miles in length, for the Great Western Railway Company. Engineer, Paddington Station ... ... April 11

Bantry (Ireland).—Execution of works for carrying out the scheme for providing an additional supply of water for the town of Bantry, for the Rural District Council, according to plans and specification deposited for inspection in the Board room of the Council. Mr. Richard Croly, clerk, Board Room, Bantry ... ... April 11

Batley.—The following works in connection with the extension of the tramways in Bradford Road, for the Corporation: (Contract No. 14) permanent-way construction and paving; (15) overhead equipment, steel poles, etc.; (16) feeder cables, conduits, and accessories. Messrs. Lacey Sillar and Leigh, 2, Queen Anne's Gate, Westminster, S.W. ... ... April 17

Glasgow.—Electric power generating and lighting plant for Clydebank Dock, for the Trustees of the Clyde Navigation. Mr. T. R. Mackenzie, general manager and secretary, 16, Robertson Street, Glasgow, or from Mr. Geo. H. Baxter, mechanical engineer ... ... April 17

Last Day.

New South Wales.—Tenders will be received at the office of the Secretary for Public Works, Sydney, Australia, up to 2 o'clock p.m. on Friday, September 1st, 1905, for the manufacture, supply and delivery in the State of New South Wales of all iron and steel required by the Government. Full particulars may be obtained from the Agent-General's office, 9, Victoria Street, London, S.W. ... ... Sep. 1.

Aberdeen.—Supply of one surface condenser, with air pump, oil separator, etc., for the Electricity Department. Mr. J. Alex. Bell, city electrical engineer, Corporation Electricity Works, Millburn Street, Aberdeen ... ... April 19

Merthyr Tydfil.—Construction of certain waterworks, consisting of an aqueduct from the existing Neuadd resorvoirs in the Taff Fechan Valley, and extending for a distance of about 16 miles towards the southern boundary of the district, for the Merthyr Tydfil Urban District Council. Mr. Geo. F. Deacon, 15, Great George Street, Westminster, S.W. ... ... April 19

Manchester. — Construction of a new curve and the widening of a portion of their main line at Throstle Nest, Manchester, for the Cheshire Lines Committee. Mr. Harry Blundell, engineer to Cheshire Lines Committee, Central Station Liverpool ... ... April 27

Bishop's Stortford.—Carrying out of the following works at their sewage pumping station, for the Bishop's Stortford Urban District Council: (Contract No. 1) For supplying and fixing two Lancashire boilers, 18 ft. long by 6 ft. 6 in. diameter; (2) for supplying and fixing steam pumping engine and pumps. Mr. Thos. Swathebridge, 7, North Street, Bishop's Stortford ... ... May 8

COMING CONTRACTS.

Burnley.—The Electricity Committee has decided to purchase more plant, which will comprise a 500 k.w. generator, boiler and condensing plant.

Barnsley.—A loan of £4,403, for extensions at the electric lighting works has been applied for by the T.C.

London County Council.—At the last meeting, the Council approved an expenditure of £50,000 in connection with the purchase of the undertaking of the Woolwich and South-East London Tramways Co.

Ackworth.—An inquiry has been held by the Light Railway Commissioners into the Ackworth and North Lindsey light railway scheme. The total mileage proposed is 53, and the cost is estimated at £580,000.

Wantage.—The Council have adopted a report recommending the construction of new sewage works on a site where sufficient fall could be obtained to permit the construction of a percolating filter or double-contact beds.

Holyhead.—The construction of a landing-pier for passengers in the new harbour is deferred, pending the settlement of financial questions which have arisen.

Fleetwood.—A start has been made with the sewage scheme, which is estimated to cost £60,000.

Western Valleys Sewerage Board.—The Board is issuing a loan of £250,000 for new works.

Warwick.—An inquiry has been held into an application by the Town Council for leave to borrow £11,500 for waterworks.

Wisbech.—An application for sanction to borrow £25,000 for electric lighting purposes is under consideration.

CONTRACTS CLOSED.

Glasgow.—The Steel Company of Scotland, Ltd., has placed a contract with Mr. P. J. Mitchell, of London, for a complete installation of Rateau patent exhaust accumulator regenerators, together with necessary turbo-generating plant, condensers, cooling tower, etc. The plant will eventually, when the second unit is installed, provide the works with 1,300 e.h.p., without any increase on the present fuel costs.

Aberdeen.—The Lighting Committee has recommended that the tender of Bruce Peebles and Co. be accepted for a 420 k.w. generator.

Stockport.—The Tramways Committee have accepted the tender of Messrs. J. and W. S. Briscoe, Longshut-lane, Stockport, amounting to £10,326 12s. 5d., for the construction of the roadway in connection with the Hazel-grove tramways.

Manchester.—John Collier and Co., of Manchester, have recently secured an order from the Manchester Ship Canal Company for switchboards, feeders (over 20 miles lead and paper-covered cables in earthenware ducts) for power and lighting, required at their new dock in course of construction.

Admiralty.—Sir W. G. Armstrong, Whitworth and Company, Ltd., have recently secured the Admiralty contract for the supply of all high-speed steel required in the home and colonial dockyards during the next three years.

India.—The contract for a new bridge over the river Indus, at Khushalgarh, has been placed by the Secretary of State for India with the Tees Side Bridge and Engineering Works, Ltd., of Middlesbrough and London. The bridge, which has a double deck, carrying the railway on the top and a roadway below, consists of a cantilever span of 471 ft.—the slung portion being 261 ft. 8 in.—and an anchor span of 303 ft.

Battersea.—The Borough Council have accepted the tender of Babcock and Wilcox, Ltd., in connection with the extension plant now being provided at the central electric generating station, at £1,810.

London.—The Chain Belt Engineering Company, Derby, has recently received an order for three complete sugar-conveying plants to be installed at a large sugar refinery in the East End of London.

Swansea.—The Swansea Harbour Trust have ordered three 14-in. locomotives from Andrew Barclay, Sons and Co., Ltd., of Kilmarnock.

Pittsburg.—The Kennicott Water Softener Company informs us that it has just sold to the Carnegie Steel Company, Pittsburg, Penn., the largest continuous water softener that has ever been erected, viz., of a capacity of 150,000 gallons per hour. This machine will be 60 ft. high and 50 ft. in diameter, and the water to be treated is not only quite hard, but is full of free sulphuric acid, caused by the sludge of the coke ovens and rolling mills being drained into the river at that point.

APPOINTMENTS VACANT.

Last Day.

London County Council.—Two divisional inspectors (at £600 per annum, rising by annual increments of £25 to £800), one possessing special qualifications in mathematics and science and the second in technology, including electrical and mechanical engineering; also an inspector in wood and metal work at £400, rising to £500... April 1

India Office.—The Secretary of State for India is now prepared to receive applications for about thirty-five appointments of civil engineers for temporary service in India. Particulars from the Secretary, Judicial and Public Department, India Office, Whitehall, S.W. —

Ipswich.—The Ipswich Dock Commissioners are about to appoint a harbour and dock master. Salary, £275, and a house with office and clerk. Particulars from Mr. Henry C. Casley, clerk, Ipswich. April 8

APPOINTMENTS FILLED.

Rotherham.—Mr. Edward Cross has been appointed borough electrical engineer and general tramways manager at a salary of £350.

Salford.—The Salford Tramways Committee have appointed Mr. Geo. W. Holford, manager of the Corporation tramways, in succession to Mr. E. Hatton, who is leaving for Newcastle-on-Tyne.

Croydon.—Mr. D. A. Mason has been appointed superintendent of the Electricity Works.

Denbigh.—The Denbigh County Council has appointed Mr. Walter Douglas Wiles, who has been attached to the city engineer's office, Norwich, for the last eight years, as county architect and surveyor at a salary of £650 a year.

G.W.R.—Mr. Alfred Baldwin has been elected Chairman of the Great Western Railway, in succession to Earl Cawdor, who has had to resign owing to his appointment as First Lord of the Admiralty, in place of Lord Selborne. Mr. Baldwin is the son of Mr. George Baldwin, ironfounder, of Stourport, and Chairman of the well-known firm of Baldwins, Ltd.

Newport.—The Works and General Purposes Committee of the Newport Corporation recommend the appointment of Mr. A. G. Dovey, now in the engineer's department of the Corporation, as deputy borough engineer.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows :—
Consols: April 5th. General Settlements: April 13th, 28th, May 12th. Bank Rate, March 9th, 1905, 2½ per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2⅞ — 3⅛
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	4½ — 5
3,210,000	1	2/6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	$3\frac{5}{16}$ — $3\frac{7}{16}$
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜ — 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 —104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	1/7⅕	Babcock and Wilcox, Ltd., Ord.	1	4⅜ — 4⅝
100,000	1	7⅕d.	Do. ,, 6% Cum. Pref.	1	1½ — 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5 — 5½
250,000	1	6⅗d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 —103
150,000	4½	2/8⅖	Barrow Hæmatite Steel Co., Ld., O.	4½	1⅜ — 1⅝
50,000	4½	6/-	Do. do. Cum 2nd. Pref.	4½	4⅜ — 4⅝
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾ — 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	103 —105
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾ — 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	99 —101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	⅝ — $\frac{11}{16}$
300,000	1	6⅗d.	Do. 5½% Cum Pref.	1	⅞ — 1
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1 —$1\frac{1}{16}$
1,860,900	1	3⅗d.	Do. Nos. 1,639,101-3,500,000	12/-	$\frac{17}{32}$ — $\frac{19}{32}$
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1⅛ — 1¼
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	$1\frac{25}{32}$ — $1\frac{27}{32}$
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11 — 11½
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord.	5	8¼ — 8¾
232,500	5	2/6	Do. 5% Cum. Pref.	5	$5\frac{5}{16}$ — $5\frac{7}{16}$
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	1 — $1\frac{1}{16}$
70,000	5	2/6	Do. 5% Cum. Pref.	5	5½ — 5¾
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	100 —102
100,000	10	7/6	Consett Iron Co., Ltd., Ord.	7½	32— 33
57 031	10	10/-	Crossley, Bros., Ld., Ord. 40340/97370	10	16 —16½
40,339	10	5%	Do. 5% Cum. Pref.	10	11⅝—11⅞
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2 — 2¼*
1,259,594	1	3⅗d.	Dorman, Long & Co., Ltd.	1	⅝ — $\frac{11}{16}$
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	91 — 94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	3¼ — 3½
250,000	1	9⅗d.	Dunlop (James) & Co., Ltd., Ord.	1	$\frac{9}{16}$ — $\frac{11}{16}$*
300,000	1	7⅕d.	Do. 6% Cum. Pref.	1	$\frac{15}{16}$ - 1
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9½ — 10½
69,754	13	12/-	Do. do. do.	10	7¾ — 8
20,250	10	8/-	Elliott's Metal, Ltd.	8	4¾ — 5¼
5,000	10	5%	Do. Cum. Pref. 5%	10	8¾ — 9¼
186,748	Stk	4%	Do. Deb. 4%	100	94½ — 96½
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	10¾ — 11¼
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk .Red.	100	100 —103
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000	10	12½—12¾
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½—10
126,000	8	3/-	Fraser & Chalmers, Ltd., Ord.	8	4⅝ — 4⅞
21,000	8	1/6	Do. 7½% Cum. Pref.	8	5¾ — 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red.	100	90½—91½
16,800	10	—	Greenwood & Batley, Ltd., Ord.	10	4¼ — 4½
9,600	10	7%	Do. 7% Cum. Pref.	10	10¼ — 10¾
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2⅜ — 2½
344,000	5	2/6	Do. 5% Cum. Pref.	5	5⅞ — 6⅛
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	107 —109
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2 — 3
250,000	1	3/6	Hadfield's Steel F'dry Co., Ld., Ord.	1	3 — 3⅛
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10¾ — 11¼
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd.	1	1¼ — 1⅜*
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	10¾ — 11
28,001	5	7/-	Head, Wrightson & Co., Ltd.	5	5 — 5½
85,000	1	7⅕d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	¾ — ⅞
18,000	5	3/-	Do. 6% Cum. Pref.	5	4¾ — 5
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5½ — 6
750,000	1	6d.	Howard & Bullough, Ltd., Ord.	1	1⅝ — 1¾
25,000	10	6/-	Do. 6% Pref. (Non-Cum.)	10	13 — 13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 —101
37,500	10	20	Kynoch, Ltd.	10	18¾ — 19¼
49,537	10	5%	Do. Cum. Pref. 5%	10	10¾ — 11
300,000	1	4⅘d.	Lambert Bros., Ltd., Ord.	1	⅝ — ⅞
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1⅕	Leeds Forge Co, 7% Cum. Pref.	3	3¾ — 4¼*
200,000	1	7⅕d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	$1\frac{5}{16}$ — $1\frac{7}{16}$
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	108 —110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11 —11½
210,000	1	8⅖d.	Measures Bros., Ltd., Ord.	1	$\frac{9}{16}$ — $\frac{11}{16}$
75,000	1	6⅗d.	Do. 5½% Cum. Pref.	1	⅞ — 1
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	94 — 97
21,943	5	2/6	Muntz Metal, Ltd.	5	5½ — 5¾
14,248	5	5%	Do. Pref. 5%	5	5 — 5¼
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	76 — 80
78,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12 —12½*
80,000	5	—	North-Eastern Steel Co., Ltd., Ord.	5	—
£250,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
122,000	5	2/-	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	4 — 4¼
50,000	5	3/-	Do. 6% Cum. Pref. "A"	5	6 — 6½
70,000	10	6/-	Pease & Partners, Ltd., Ord.	10	10¼ — 10¾
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	98 —101
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	4⅞ — 5⅛
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord	1	6/- — 6/6
13,000	5	—	Do. 5½% Cum. Pref.	5	4 — 4¼
230,000	1	—	Projectile Co. (1902), Ltd., Ord.	1	½ — ⅝
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅞ — 2
73,062	5	2/-	Do. New	5	1½ — 1¾
£330,000	—	5%	Do. 5% Mort. Deb., Red.	100	101 —103
350,000	1	7⅕d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf.	1	⅞ — $\frac{15}{16}$
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock	100	94 — 96
35,000	10	12/-	Ruston, Proctor & Co., Ltd.	10	9½ — 10
275.000	1	6d.	Scott (Walter), Ltd., Ord.	1	$\frac{13}{16}$ — $\frac{15}{16}$
300,000	1	7⅕d.	Do. 6% Cum. Pref.	1	1— 1⅛
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 96
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red	100	92 — 95
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	⅝ — $\frac{11}{16}$
300,000	1	1/2⅖	Do. 6% Cum. Pref.	1	$\frac{27}{32}$ — $\frac{29}{32}$*
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	89 — 92
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560	9	5¼ — 5⅜
£125,240	Stk.	5%	Do. 5% Trust Mort. Deb.	100	106½—107½
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2¼ — 2¾
25,000	10	5/6	Do. 5½% Cum. Pref.	10	4¼ — 4¾
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	79 — 82
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	17½ — 18
55,000	10	6/-	Do. 6% Cum. Pref.	10	14¾ — 15¼
684,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	¾ — ⅞*
538,845	1	6d.	Do. 5% Cum. Pref.	1	⅞ — 1*
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	98 — 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ — $\frac{9}{16}$
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	67 — 71
£160,000	1	7⅕d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	$\frac{15}{16}$ — $1\frac{1}{16}$
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½ — 10
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	35⅝ — 35⅞
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	97 — 97½
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	97 — 99
3,350,000	1	1/6	Vickers, Sons & Maxim, Ltd. Ord.	1	$2\frac{7}{16}$—$2\frac{9}{16}$*
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	$1\frac{3}{16}$ —$1\frac{5}{16}$*
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	117 —120*
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	106 —108
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	106 —108
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	¾ — ⅞
500,000	1	7⅕d.	Do. 6% Cum. Pref. Ord.	1	⅞ — 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	85 — 89
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4⅜ — 4⅞
300	Stk	4½%	Do. Mort. Deb. 4½%	100	91 — 97
66,666	5	3/.	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	3 — 4
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	75 — 80
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	81 — 86

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝— ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7/16— 9/16
120,000	1	9⅗d.	Bell's Asbestos Co., Ltd.	1	¾— ⅞
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5¾— 6¼
100,000	5	3/-	Do. 6% Cum. Pref.	5	5¼—5¾
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 —104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	99 —101
400,000	5	8/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref. ..	5	8 — 8¼
£616,358	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	91 — 93
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½— ¾
150,000	2	2/4⅘	Do. 6% Pref.	2	1½— 1¾
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92 — 95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	79 — 82
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	11 — 11½
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5½— 5¾
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	106 —108
85,000	3	1/6	Crompton & Co., Ltd...	3	2⅛— 2⅜
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	93 — 98
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	8 — 8½
61,000	5	8/-	Do. 6% Cum. Pref.	5	5⅞— 6⅛
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 —107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛— 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106 —109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1 — 1¼
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1¾— 2¼
£314,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	80 — 85
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	86 — 91
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	1⅛— 1¼
31,390	2	2/9⅗	Do. 7% Cumulative Pref. ..	2	2¼— 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 — 99
10,248	10	7/6	Evered and Co., Ltd.	10	12 — 14
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½— 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 — 96
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	12½—13*
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅜— 5⅝
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	16 — 17
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 —103
7,500	10	—	Parker, Thos., Ltd.	10	6½— 7*
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/-—17/-
37,350	12	24/-	Telegraph Construction and Maintenance Co., Ltd.	12	36 — 38*
£150,000	100	4%	Do. 4% Deb. Bonds	100	103 —105

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅝— 8⅞
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅝— 5⅞
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	12 — 12½
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 -- 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 --102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 —100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	13/16— 15/16
59,394	1	11·49d	Do. 5% Cum. Pf. ..	1	15/16— 1 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1 — 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾— 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	103 —106
		%	Pref. Ord. Stock	100	100 —103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¼— 9¾
156,487	10	6/-	Do. 6% Cum. Pref.	10	10⅞—11⅛
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	122 --124
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	98 —100
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3¾— 4
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5⅜— 5⅞
27,000	5	3/-	Do. "B" do.	5	5⅜— 5⅝

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	95 — 98
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	103 —106
102,268	5	3/-	Calcutta Tramways Co., Ltd. ..	5	8⅜— 8⅝
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 —108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅜— 1⅝
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4⅞— 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101 —104
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	103 —105
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½— 14½
59,987	10	6/-	Do. 6% Pref...	10	15½— 16½
80,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3 — 3½
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	89 — 92
125.000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10 —10½
£1.031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	99 —102
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	101 —103
814,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	13/32—15/32
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 — 1 1/16
£850,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105 —107
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½— 1½
110,923	8	3/2⅖	North Metropolitan Tramways Co..	8	3¾— 4¼
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	105 —108
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	9¾— 10¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9½— 10
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	103 —107

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12¼— 12¾
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9¾— 10¼
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	105 —107
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼— 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	103 —106
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10¼— 10¾
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	10 — 10½
60.000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9¼
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	8 — 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5½— 5¾
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	105 —107
44,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6¾— 7¼
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	109 —111
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	11½— 12*
40,000	10	6/-	Do. 6% Cum. Pref.	10	13½— 14*
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	123 —127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 —105
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9½— 10
30,000	10	6/-	Do. 6% Cum. Pref.	10	12¼— 12¾
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	110 —113
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	6⅛— 6⅜
70,000	5	3/-	Do. 6% Cum. Pref.	5	6⅛— 6⅜
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	106 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
10,000	5	2/-	Folkestone Elec. Supply Co., Ld., O.	5	5½— 6
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 —104
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9½—10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord.	5	7¾— 8¼
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	101—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	⅝—
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12½— 13

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	1/9⅗	London Elec. Supply Corp., Ld., Ord.	3	$2\frac{9}{16}$—$2\frac{13}{16}$
60,000	5	3/-	Do. 6% Pref.	5	5¾ — 6
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 —101
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	18 —18½*
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅝ — 5¾
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	110 —115
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	97 — 99
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99 —101
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½—15½*
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	102 —104
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼— 6½*
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —102
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13¾—14¼
20,000	5	3/6	Do. 7% Pref...	5	8½— 8¾
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅝— 3⅛
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	79 — 83
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	4 — 4¼*
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅞ — 1
50,000	1	8⅖d.	Do. 7% Cum. Pref.	1	$1\frac{5}{16}$—$1\frac{7}{16}$*
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	107 —110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	$5\frac{1}{16}$—$5\frac{3}{16}$
30,000	5	2/6	Do. 5% Cum Pref.	5	5⅛— 5¼
£200,000	Stk	—	Do. 4½% 1st Mort. Deb. Stk. Red	100	106 —108
110,000	5	7/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½—13
28,151	5	2/6	Do. 5% Cum. Pref.	5	6¼— 6¾

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ — 2¾
£763,580	Stk	17/6	Anglo-American Tel. Co.. Ltd., Ord.	100	61 — 63
£3,118,210	Stk	35/-	Do. 6% Preferred Ordinary	100	108½—109½
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	16¼—16½
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6⅝— 6⅞
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	230 —240
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	98 —100
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾— 9¼
6,000	10	10/-	Do. 10% Preference	10	17 — 18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝
		5/-	10% Cum. Preference	5	8½— 9
£30,000	50	4½%	Do. 4½% Debs..	50	101-103%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11⅜—11⅝
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100—102
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101-103%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14¼— 14¾
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105 —107
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	145 —148
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	92 — 94
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	107 —109
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	37 — 39
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100—102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	47 — 49
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	$\frac{13}{16}$— $\frac{15}{16}$
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	109½-110½*
£1,966 667	Stk	5%	Do. Deferred	100	103½-105½*
250,000	5	2/6	Do. 6% Non-Cum. 3rd Pref.	5	5⅜ — 5⅝*
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	100—102
£689,593	Stk	4%	Do. 4% do. do. ..	100	103½—105½
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1¼ — 1⅜
50,000	1	7½d.	Do. 6% Cum. Pref.	1	$1\frac{3}{16}$ — $1\frac{5}{16}$
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	98 —101
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7½— 7¾
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7 — 7½
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5¼
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	107—109
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	8 — 8½
£30,008	2½	—	West Coast of America, Ltd. ..	2½	$\frac{5}{16}$— $\frac{7}{16}$
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100 — 102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅞ — 1
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8½— 9
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	8¼ 8¾
£80,000	100	5%	Do. 5% Deb.	100	103 —105
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13¾— 14¼
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8½— 9
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	100—102
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	94 — 96
40, 000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 — 6½
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	78 — 81
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	100 —102
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	13¾— 14¼
40,000	20	8/-	Do. Nos. 60,001-100,000	10	5¾— 6¼
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	101 —103
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	$1\frac{3}{16}$—$1\frac{5}{16}$
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4½— 5
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	7¾— 8¼
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	101—102
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2½— 3
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3 — 3½
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 — 86
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	5¼ 5¾
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	132 —135
£1,160,000	Stk	19%	Do. do. Deferred ..	100	228 —231
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	25½— 26½
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼— 8¾
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10¼— 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9⅗d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1— 1⅛
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	130 —135*
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	$\frac{5}{16}$— $\frac{7}{16}$
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	$\frac{9}{16}$— $\frac{11}{16}$
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	$1\frac{1}{16}$— $1\frac{3}{16}$
135,000	1	7½d.	Do. 6% Cum. Pref. ...	1	1⅛— 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

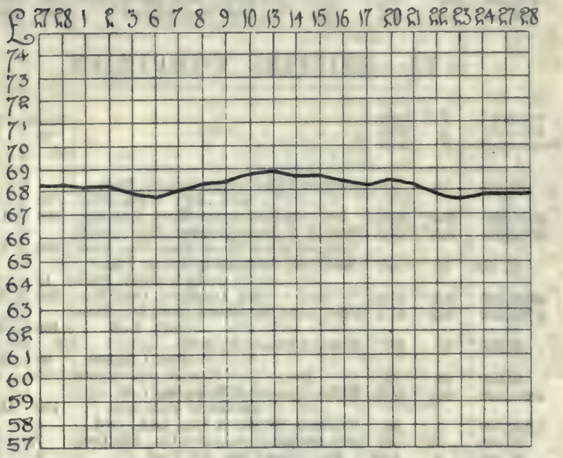
Present Amount Subscribed,	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car, & Wagon, L., 1-10,000	10	21 —22
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8¾— 9
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 —13¼
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9 — 9¼
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	3⅞— 4⅛
14,567	10	1/3	Lancashire Wagon, Ord.	2	$2\frac{3}{16}$—$2\frac{5}{16}$
4,150	10	5%	Do. do.	10	10½—10¾
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	41/—42/
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/6 —24/6
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	27/6 —28/6
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	18¾—19¼

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM FEBRUARY 27TH TO MARCH 28TH, 1905.

COPPER.



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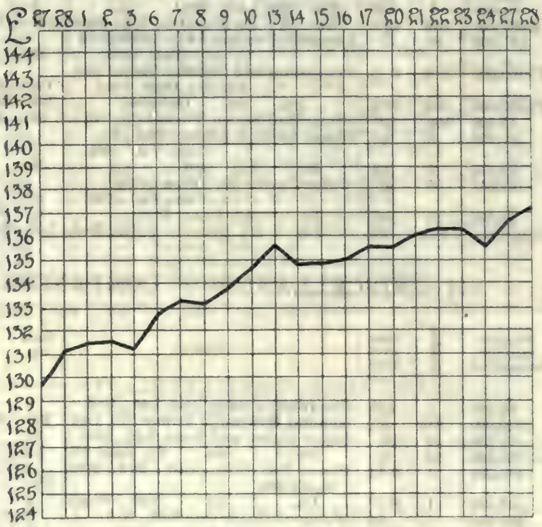
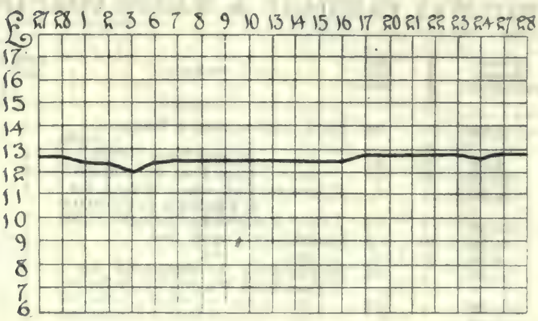
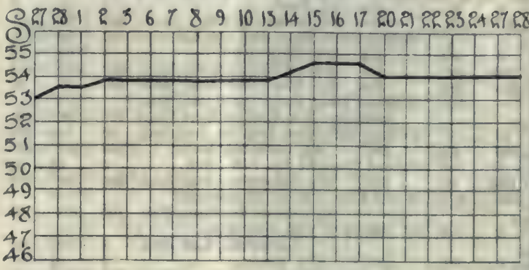


ENGLISH LEAD.



PIG IRON: SCOTCH,



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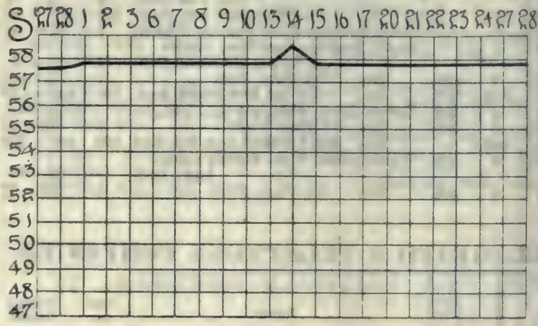
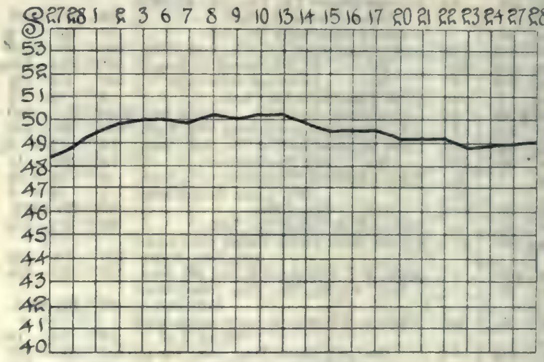
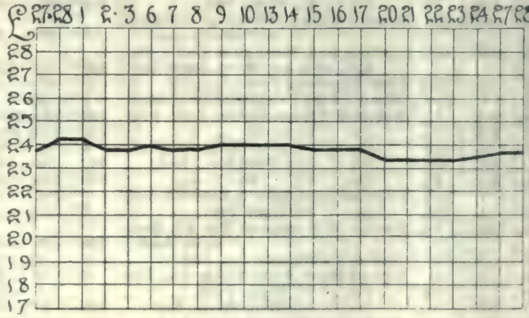


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, March 29th, 1905.

THERE have been no fresh developments in the Copper market during the past week, the speculative spirit having temporarily subsided. At one time the bear party made a partially successful attempt to depress prices, and forward metal was sold down to £67 17s. 6d. At this level buyers came forward and put the price to over £68, and the market remains steady round about that figure. Quiet, without weakness, would, perhaps, best describe the position at the moment. The closing price to-day was £67 15s. cash, and £68 three months.

Tin has been a firm and active market, and as high as £137 10s. has been paid for spot metal. The outstanding event of the week has been the publication of a report that the production of Banca tin for the current year would only amount to 150,000 piculs, which is considerably less than was anticipated, and makes the market more easy of manipulation. The available supplies are now under very strong control, and although in view of the impending Banca sale quotations were temporarily depressed, the market has during the past day or two developed considerable strength. The margin between cash and forward metal is considerable, the prices quoted yesterday being respectively £137 10s. and £134 15s.

In the Lead section holders have played a waiting game with the result that buyers had to advance their prices. Manufacturers are rather more busy, and as stocks are low a further improvement in quotations may be anticipated. The market was quietly firm yesterday, closing prices being soft foreign prompt £12 10s., English £12 15s.

Spelter is lower, the poor character of the demand having induced holders to make some concession in the matter of price. The quotation for spot metal has been down to £23 7s. 6d., but some recovery from this quotation is to be noted.

In the Iron and Steel section, notwithstanding optimistic accounts from the United States our markets have been a little unsettled. Fluctuations, however, have been within comparatively narrow limits, and the closing price of Cleveland yesterday, 49s. 1d. cash, shows only a small decline on the week.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

	£	s.	d.
Steel :			
Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
,, ,, ,, Land ,, ,, ...	6	17	6
,, Steel Bars, Boiler Quality	6	17	6
Siemens' Steel Plates, Ship Quality Plates......	5	17	6
,, ,, Bars ,, ,, ...	6	7	6
,, ,, Angles..............................	5	7	6
Manufactured Iron :			
Bars—Dalzell..................................	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle..	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

	£	s.	d.	
Steel Angles (Glasgow ♛ Steel)...............	5	7	6	per ton.
Steel Ship Plates (Glasgow ♛ Steel)	5	17	6	,,
Steel Bars, Ship Quality (Glasgow ♛ Steel)	6	7	6	,,
Steel Bars, Boiler Quality (Glasgow ♛ ♛ Steel)	6	17	6	,,
Steel Land Boiler Plates (Glasgow ♛ ♛ Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow ♛ ♛ Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote :—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best......................................	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix		—	
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:

	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	3	4	6	2	14	0
Gartsherrie ,,	2	19	0	2	14	0
Summerlee ,,	2	19	0	2	14	0
Carnbroe ,,	2	16	6	2	12	6
Langloan ,,	3	4	0	2	15	0
Calder ,,	2	19	0		—	
Clyde ,,	2	18	6	2	13	6
Glengarnock, f.o.b. Ardrossan	2	18	0	2	12	6
Eglinton ,, ,,	2	14	6	2	12	6
Dalmellington, ,, Ayr	2	14	6	2	12	6
Shotts ,, Leith	2	19	0	2	14	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♕ Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby ♕	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. ♕ Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2¼ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron.			Steel.		
		£	s	d.	£	s.	d.
♛ (BNF)	Bars	6	10	0	6	15	0
	Angles	7	0	0	7	5	0
	Tees	7	10	0	7	15	0
♛ W.I.W	Hoops	7	0	0	7	10	0
	Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets:	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
	£	s.	d.	£	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	12	6	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	5	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	12	6	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis :—
2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—
2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote :—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	12	0
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	0
C 20 by 14 112s. 108 ,, "Lydbrook"	0	11	9
C 28 by 20 112s. 216 ,, "Lydbrook"	1	3	9
Charcoal Tinplates :			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	6

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes :—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	3	14	0	per ton.
Billets	at	3	16	0	,,
Sheet Bars	at	3	18	0	,,
Finished Steel :					
Bars	at	5	1	0	per ton.
Angles	at	5	2	0	,,
Tees	at	5	5	0	,,
Joists	at	4	10	0	,,
Fencing Standards	at	5	2	0	,,
Shoeing Bars	at	5	4	0	,,
Tyre Bars	at	5	4	0	,,
Half-Round Bars	at	5	5	0	,,
Heavy Rails	at	4	15	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork :

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote :—

TIN.

	£	s.	d.		£	s.	d.	
Tin:								
English Ingots, f.o.b. Dis. 1¼% & 1%	136	10	0	to	137	0	0	per ton.
English Bars, f.o.b. Dis. 1¼% & 1%	137	10	0	to	138	0	0	,,
Straits G.M.B., cash Warehouse, Net	136	17	6	to	137	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	134	15	0	to	135	0	0	,,
Australian, Mt. Bischoff, Warehouse, Net	136	17	6	to	137	12	6	,,

COPPER.

	£	s.	d.		£	s.	d.	
Copper:								
Standard G.M.B., cash Warehouse, Net	67	15	0	to	67	17	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	68	5	0	to	68	6	3	,,
English, Tough, Cake & Ingot, Warehouses, Net	71	0	0	to	71	10	0	,,
English, Best Select, Warehouse Net	72	0	0	to	72	10	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	81	0	0	to	82	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex. ship	0	12	0	to	0	13	0	per unit.
Regulus, Matte and Precipitate, ex. ship,	0	13	3	to	0	14	0	,,

YELLOW METAL.

	£	s.	d.	
Yellow Metal :				
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6¾	per lb.
Sheathing ,, ,,	0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	23	10	0	to	23	15	0	per ton
Blende of 50 % Net	6	11	6	to	6	15	0	,,
Calamine, Net	6	14	0	to	6	15	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	12	15	0	to	12	17	6	per ton.
Spanish, ex ship, Dis. 2½%	12	8	9	to	12	10	0	,,
Lead Ore of 70 %, Net	6	2	6	to	--			,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	35	0	0	to	36	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	8	10	0	to	9	10	0	,,
Crude, ex ship, Dis. 2½ %	15	0	0	to	17	10	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	12	6	per flask.
Italian ,, ,, ,,	7	11	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	7	6
Best Hard Steam (hand picked, as used by the Railway Companies)	6	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.	s.	d.
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.

HIGH HAZEL.		
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, ¾ to 2 in. cube	5	6

STEAM.—TOP HARD.		
Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb.
Picric, Crystals	0	0	11	,,
Tartaric at Manchester	0	0	10⅞	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	9	10	0	per ton.
Grey ,,	11	10	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	24	0	0	per ton.
Sal-ammoniac, Lump, 1sts, del$^{d.}$ U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	12	15	0	,,
Arsenic: Best White Powdered net	12	7	6	,,
Bleaching Powder, 35% ,,	4	10	0	,,
Borax: British Refined Crystal ,,	12	0	0	,,

Coal Tar Products:

	£	s.	d.	
Benzole, 50/90 % ,,	0	0	6	per gal.
,, 90% ,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C. ,,	0	0	6	per lb.
,, ,, ,, 39/40° C. ,,	0	0	6¼	,,
,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	9	,,
Creosote, ordinary good liquid ,,	0	0	1⅝	,,
Naphtha, Crude, 20 % at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b. ,,		1	0	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	11	6	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	19	0	,,
Cake ,,	1	2	6	,,
Copper: Sulphate	22	0	0	,,

Cyanides: 98% minimum f.o.b. net	0	0	7½	per lb.

Lead: Acetate (Sugar) White. English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	23	5	0	,,
,, ,, Grey	21	15	0	,,
,, ,, Brown at Manchester	17	0	0	,,
Nitrate	24	0	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,

Naphtha (Wood): Miscible, 60 o.p.	0	2	10	per gal.
Solvent	0	2	7	,,

Potash: Bichromate... delivered England	0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull	18	10	0	per ton.
Caustic, 75/80 % ,, ,,	20	15	0	,,
Chlorate net	0	0	3$\frac{1}{16}$	per lb.
Montreal in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow net	0	0	5	per lb.

	£	s.	d.	
Soda: Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
,, ,, ,, Refined...... ,,	6	5	0	,,
,, Carbonated, 48 %........... ,,	5	10	0	,,
,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
Caustic, White, 77 %.............. ,,	10	10	0	,,
,, ,, 70 %.............. ,,	9	12	6	,,
,, ,, 60 %.............. ,,	8	12	6	,,
,, Cream, 60 %............ ,,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate .... c.i.f. Hull net	17	10	0	,,
Bicarbonate, in 1 cwt. kegs............	6	15	0	,,
Bichromate......delivered England...	0	0	2¼	per lb.
Chlorate .... net	0	0	3 1/16	per lb.
Nitrate...ex quay Liverpool, ... ,,	11	7	6	per ton.
Phosphate	9	5	0	,,
Prussiate ....net	0	0	3⅝	per lb.
Silicate, Solution, 140° Tw.	4	10	0	per ton.
Sulphate (Glauber Salts)................	1	12	6	,,
,, (Saltcake, 95%)................	1	15	0	,,
Sulphur: Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers..	7	10	0	,,
Zinc: Sulphate	6	15	0	,,

MINERALS.

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%	3	10	0	per ton.
Sulphate, No. 1, White	2	15	0	,,
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports..........	3	7	6	,,
Manganese: Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre: French JC .... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc: (French Chalk).........c.i.f. Liverpool	3	10	0	,,

OILS, etc.

	£	s.	d.	
Aniline Oil ....net	0	0	4¾	per lb.
,, **Salt**........... .... ,,	0	0	4½	,,
Castor Oil: French, 1st pressure, f.o.b. Marseilles less 1½%........	22	15	0	per ton.
English, 1st pressure, f.o.r. Hull, less 2½%..............	23	0	0	,,
Cocoa Nut Oil: Ceylon, ex store Manchester...............net	29	10	0	,,
Cochin, ex store Manchester ....net	32	0	0	,,
Cotton Seed Oil: Refined at Hull, less 2½% naked	13	15	0	,,
Edible...at Hull, less 2½% naked	14	5	0	,,
Glycerine: Crude, 80% .... net	31	0	0	,,
Linseed Oil: Raw......at Hull, less 2½% naked	14	5	0	,,
Boiled......at Hull less 2½% naked	15	5	0	,,
Starch: American Pearl...at Manchester, net	8	15	0	,,
Dextrine............ ,, ,,	17	15	0	,,
Farina............... ,, ,,	15	10	0	,,
Shellac: Standard TN orange spot		147/-		per cwt.
Turpentine: American.........at Liverpool	38	0	0	per ton.
Russian ....at Hull...net	19	0	0	

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine..................	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	0
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	3	10
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks......................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	15	0		7	5	0
Lower Ports Spruce........	,,	6	10	0		6	15	0
Spruce Boards............	,,	5	10	0		6	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	0	11		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak...............	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars................	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ,,.	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics*.

5190. M. J. Roberts, London. March 13th.—Improvements in stern tubes of steamships and the like.

5212. P. B. Massey, Leeds. March 13th.—Spanner.

5218. O. B. Craft, London. March 13th.—Improvements in wrenches.

5219. H. Davey, London. March 13th.—Steam turbines.

5241. M. J. Kilroy, London. March 13th.—Improvements in metallic packings for the pistons of steam and other engines and pumps.

5246. G. W. Morrison, London. March 13th.—A gas or the like turbine.

5251. J. B. Smith, London. March 13th.—Improvements in automatic wrenches.

5274. D. C. Smith, Glasgow. March 14th.—Improvements in and relating to compounds for removing incrustation from steam boilers and the like.

5276. G. H. Wright, Derby. March 14th.—Improvements in brakes for railway goods wagons and the like.

5318. C. J. Rousseau and E. C. Ferris, London. March 14th.—Improvements in oil engines.

5330. P. B. W. Kershaw, London. March 14th.—Improvements in or relating to internal combustion engines and fluid pressure turbines.

5347. T. Clarkson, London. March 14th.—Improvements in or relating to steam generators.

5363. A. M. Descours-Desacres, London. March 14th.—Means for locking together screw nuts and bolts. (Date applied for June 3rd, 1904.)

5372. V. Ranalli, London. March 14th.—Improvement in external gas furnaces for stationary and marine steam boilers.

5412. A. Blackwell, T. Harrison, and G. Harrison, Birmingham. March 15th.—Improvements in machinery for rolling metals.

5413. K. Stewart, Glasgow. March 15th.—Improvements in and relating to the propulsion of ships or other vessels.

5424. W. Kneen, London. March 15th.—Improvements in gearing for the transmission of rotary motion.

5433. J. Henry and A. Anderson, London, March 15th.—An improved furnace grate.

5443. F. Gregory, London. March 15th.—Improvements in locking nuts for bolts, studs and the like.

5546. A. L. Hitchcock-Spencer and P. A. Sharman, London, March 16th.—Improvements in vertical steam boilers.

5549. W. J. Gordon and J. McKechnie, London. March 16th.—Improvements in and relating to piston rings.

5586. The British-Thomson Houston Co., Ltd., London. March 16th.—Improvements in multiple cylinder engines. (*General Electric Co., U.S.A.*)

5602. W Rowbotham and I. M. C. J. de Havilland, Birmingham. March 17th.—Improvements in and relating to hot air or increased volume turbines.

5604. W. Rowbotham and I. M. C. J. de Havilland, Birmingham. March 17th.—Improvein and connected with turbines.

5615. F. Chorlton, Manchester. March 17th.—An improved plug or valve.

5626. M. Buch, Coventry. March 17th.—Improvements in or relating to worm-gearing.

5627. E. W. Whitley, Leeds. March 17th.—Improvements in metal sawing machines.

5628. W. E. Barnes, London. March 17th.—Improvements in thermostatic valves. (Date applied for March 17th, 1904.)

5651. H. Sykes, Ltd., and E. Jackson, London. March 17th.—Improvements relating to pumping engines.

5666. C. E. Finch, London. March 17th.—Improvements in automatic boiler feeders.

5674. L. K. Clark, London. March 17th.—Improvements in driving mechanism.

5678. Maschinenfabrik Grevenbroich, Liverpool. March 17th. (Date applied for April 23rd, 1904.)

5683. W. W. Pagett and E. J. Guest, Stourbridge. March 18th.—An improved speed indicator for registering the speed of motors, motor-cars, motor-buses, steam-engines or other like machines, showing speed at any moment and also maximum speed attained.

5699. J. H. Walker, Liverpool. March 18th.—Improvements in boring or distilling tools. (*G. R. Ray, U.S.A.*)

5701. D. McGee, Glasgow. March 18th.—Improvements in and relating to the furnaces of steam boilers.

RECENT SPECIFICATIONS.

BALANCING DEVICES FOR HIGH-SPEED MOTORS AND MACHINES.

Sebastian Ziani de Ferranti, of London. Feb. 24th, 1904.—This invention relates to high-speed motors, such as turbines, and has for its object the provision of means for accurately balancing such rotating bodies about their axes. The invention consists in adjustably mounting balance weights on the rotating body on opposite sides of the line in which compensation is required and moving these weights circumferentially so that correct balancing is obtained. In carrying the invention into effect, equal balance-weights are provided, together with means whereby these weights may be attached to the rotating part respectively at any point of a circle described about the axis of rotation. Balancing the rotating parts of high-speed motors is thus obtained by adjustably mounting two or more weights on the rotating part to be balanced, and moving these weights circumferentially, so that correct balance is obtained without requiring alteration either of the amount of the weights or their distance from the axis.

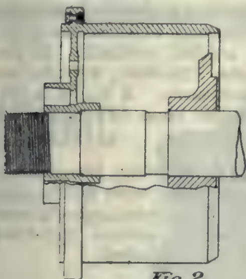


Fig. 2

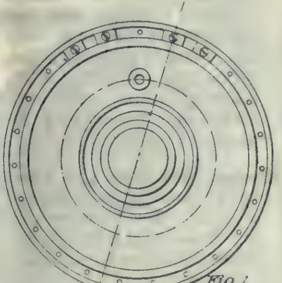


Fig. 1

Fig. 5.

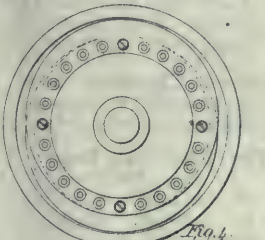


Fig. 4

TREATMENT OF EXHAUST STEAM AND FEED-WATER.

Archibald Edward Dobbs, Arthur Frederick Dobbs, and James Borthwick Kerr, of London. March 18th, 1904.—This invention relates to the treatment of exhaust steam and feed water, and is especially applicable to steam-propelled vehicles, launches and the like, where the supply of fresh water is limited. It is found in practice on steam-driven vehicles that the condenser does not always completely condense the exhaust steam, and the working of the return water-feed pump is consequently interfered with. One object of the present invention is to obviate this difficulty. Other objects are to eliminate the oil carried over from the engine. According to the invention the exhaust steam is first led to an oil separator, wherein it is allowed to whirl in contact with spirally arranged baffle plates, and the oil thereby separated centrifugally and thrown down. The steam so far separated is passed on to the condenser from which the condensed and uncondensed steam is led to a water separator, wherein it is also caused to attain a whirling motion in contact with gauze or like baffles in order to separate the water. The remaining steam is then passed on through a sinuous pipe to the feed tank, but before entering the same it is caused to pass through a filter adapted to thoroughly eliminate any oil still remaining.

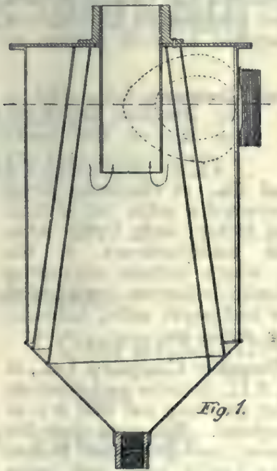


Fig. 1.

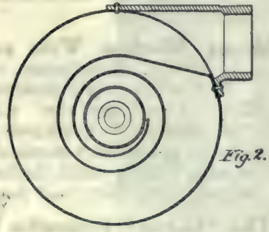


Fig. 2.

VERTICAL STEAM BOILERS.

Stephen Evans Alley, of Glasgow. April 14th, 1904. This invention has reference to and comprises improvements in and relating to vertical steam boilers, more particularly those designed for use for steam motor-wagons, and in which the water space is formed between an outer circular shell and an inner shell which is partly square or rectangular, in which are fitted a number of series of transverse water tubes crossing each other at right angles within the combustion space of fire box. The tubes are preferably fitted with a slight inclination from one side to the other to assist circulation of the water and may have gutter-shaped covers fitted over the ends, those at the lower ends having the open part turned downward and those at the higher end turned upward to assist in directing the flow of the water. The improvements of this invention consist in providing for the stoking from the upper part of the boiler down a central tube or passage and the arrangement of the inner shell of the boiler and of the water tubes to permit of this. The transverse tubes are fitted in series on each side of the stoking tube and the series of tubes are placed alternately at right angles to each other and so arranged as to leave an open space for the stoking tube. In figs. 1 and 2 the tubes are shown as fitted with gutter-shaped covers to assist in directing the flow of the water through the tubes which are set at a slight inclination for the same purpose. These covers may however be dispensed with.

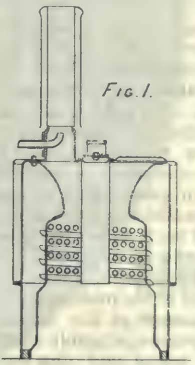


Fig. 1.

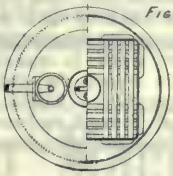


Fig 2.

NEW PUBLICATIONS.

"THE IMPERIAL DIRECTORY AND STATISTICS OF ELECTRIC LIGHTING, POWER, AND TRACTION WORKS."

Great Britain, and Ireland, India, and all British Colonies. Hazell, Watson, and Viney, Ltd. 12s. 6d. net.

This most useful directory contains in a concise and very accessible form the latest particulars of the various electrical engineering schemes in operation or projected throughout the British Empire. The inclusion of a vast amount of new matter dealing with the electric lighting, power, and traction works in India and the Colonies, has necessitated a considerable enlargement of this year's volume, which is divided into two main sections; the first covers lighting and power, tramways, light railways, standard gauge, and tube railways of Great Britain and Ireland; the second section is devoted to electrical affairs in the British Colonies and Dependencies.

The details given in each section of the work are subdivided into several heads, first a statement as to the owners of the undertaking and the powers under which the undertaking is authorised, either by Act of Parliament, Board of Trade, etc.; and then follows a list of the committees of management where the local authority own the works, or the board of directors who control the operation of limited or incorporated companies; and in each case the names of the responsible officers connected with the technical and commercial departments of each works are given. The technical portion of the works is minutely described, first, as to the system used (three-wire, alternating, etc.); then follows a short account of the machinery, cables, and meters in use, with the names of the manufacturers and the type of engine, dynamo, or cable used. This classification of the power-house and distributing equipment is useful to everyone connected with the management of these undertakings, as affording a friendly comparison between the different works in operation, and a general guide to those towns where the statutory powers are not yet put into operation. There are several other features of permanent interest included in the Directory which appear to have been compiled with painstaking accuracy.

"THE INVENTOR'S GUIDE TO PATENT LAW AND THE NEW PRACTICE."

By James Roberts, M.A., LL.B. John Murray. 2s. 6d. net.

We have called attention on a previous occasion to Mr. Roberts larger work on "The Grant and Validity of British Patents for Inventions," of which the present volume is practically an epitome. It has been specially compiled, with regard to applications made under the new Act, for those who require a lucid explanation of the law and rules governing the grant of patents in the United Kingdom. Information on how to avoid the risk and consequences of premature disclosure of ideas is given, and the writer has successfully compressed the gist of the law relating to this subject into a very small compass, while he indicates reliable sources for those who wish to follow up any special point.

BOOKS RECEIVED.

"The Home Mechanic." By John Wright. John Murray. 6s. net.

"Work." Half-Yearly Volume. Cassell and Co. 4s. 6d.

NEW CATALOGUES.

The Fairbanks Company, 78-80, City Road, E.C., forward a useful table for converting American dollars into English pounds. Rules for converting Metric to English weights and measures are also included, and incidentally the firm call attention to their weighing machines, weighbridges, trucks, portable forges, renewable valves, double tube injectors, vulcabeston packing, twist drills and hack saws. A leaflet is also forwarded illustrating the horse shoe brand Arcade files and rasps.

Messrs. Matthews and Yates, Ltd., Swinton, Manchester. In a well printed pamphlet dealing with mechanical draught, this firm enumerate the advantages claimed for their Cyclone fans, of which several half-tone illustrations and line drawings are included.

The British Accumulator Company, Ltd., of Parliament Mansions, Victoria Street, Westminster, S.W., by means of an illustrated post-card, call attention to their solid cast Planté plates.

Messrs. Chambers, Scott and Co., Motherwell, N.B. Circular No. 6 is devoted to the firm's standard electric winches, of which two illustrations are included.

The Otto Gas Engine Works, 360, Dearborn Street, Chicago. Bulletin No. 2 is an illustrated price list of the firm's specialities for the supply of water to locomotives. Illustrations are included of the Otto Stand Pipe, as well as of new style long radius tank fixtures, new balanced Otto tank valve, Snow-Milne Slow-Closing Valve Device, etc. From the same we have received a leaflet enumerating the advantages claimed for Battelle's Dry Chemical Fire Extinguisher.

Messrs. H. Sotheran and Co., Booksellers, 140, Strand, W.C. Bibliotheca Chemico-Mathematica—an interesting catalogue of second-hand scientific books, including the library of the late Professor Alexander William Williamson, F.R.S., with an appendix of English and Foreign standard works on the exact sciences.

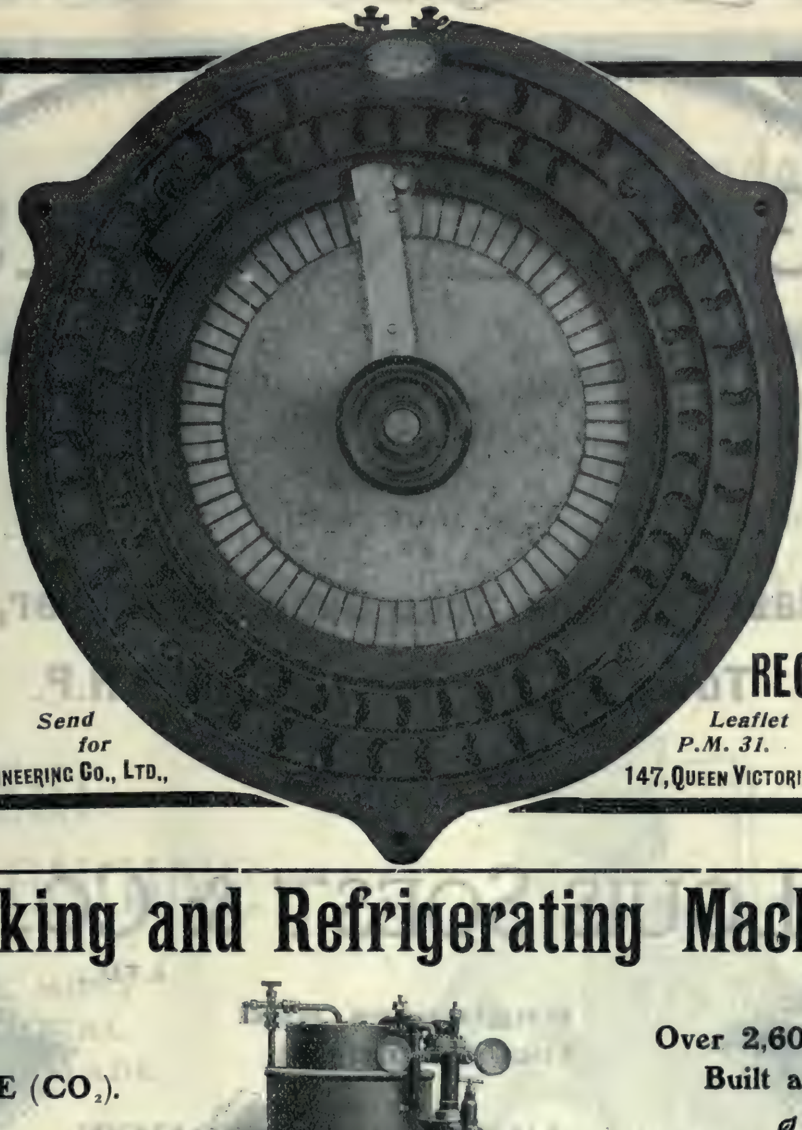
Messrs. Mather and Platt, of Salford Iron Works, Manchester, have issued a third edition of their catalogue of "D" Type Dynamos for small outputs. We note that this has been extended by the addition of three new sizes of machines to cover outputs up to 100 kilowatts.

The Simplex Steel Conduit Company, Ltd., send us the Simplex Pocket List, 1905 (Booklet No. 103—7500-3-05), an illustrated price list of the firm's manufactures.

Messrs. Matthew Wells and Co., of Hardman Street Oil Works, Manchester, forward a price list of their "Wellsaline" (Registered) Motor and Cycle Oils. This firm are the sole manufacturers of the "Wellsaline" lubricants, which include lubricating oils for cotton and woollen mills, collieries, engineering works, rolling mills, timber and paper mills, railways, steamships, corn and flour mills, etc.

The "Gaines" Reversible Propeller Company, Ltd., of 6 and 7, Stonecutter Street, E.C., describe and illustrate their propeller in a booklet, pointing out that it is of British manufacture throughout. We note that the firm also supply manganese and phosphor bronze hollow shafting, ball races, solid steel and brass shafting, and thrust blocks for all powers.

Messrs. T. D. Robinson and Co., Ltd., of Derby, forward their price list of rivets, bolts, etc.



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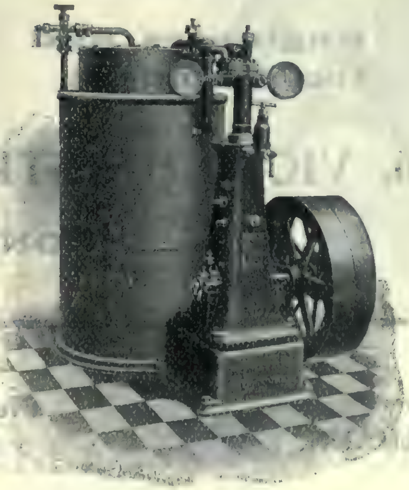

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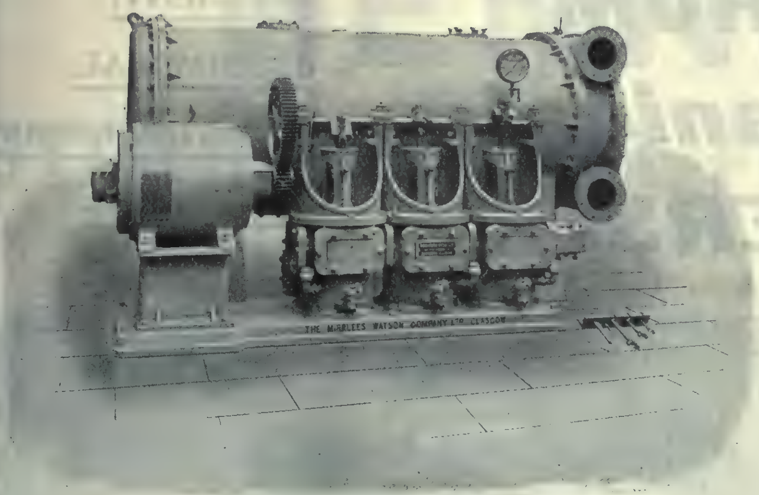

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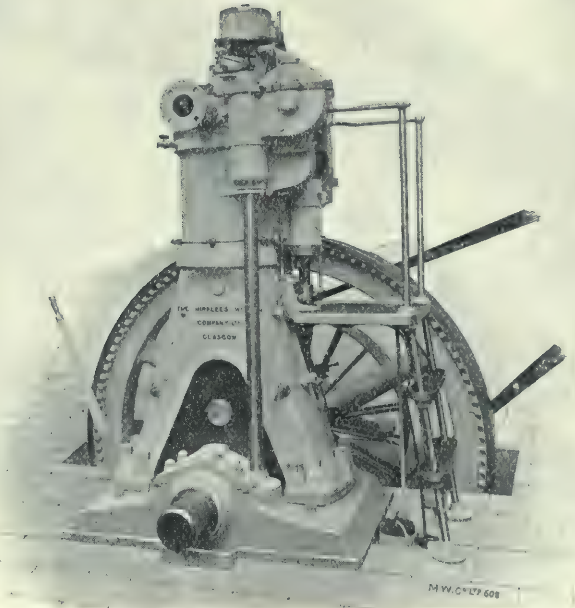

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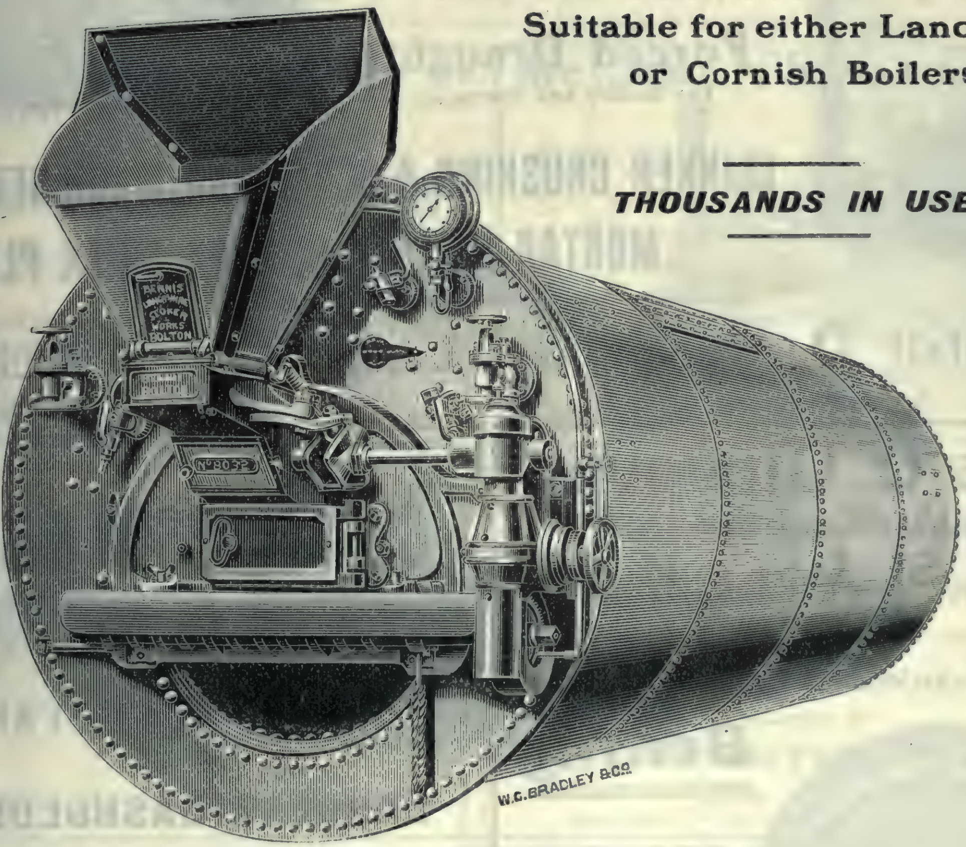

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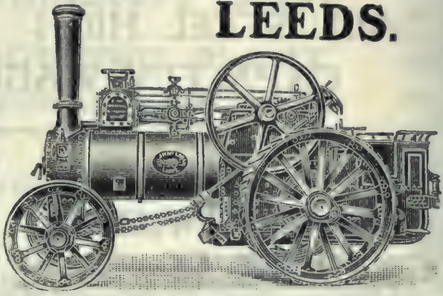

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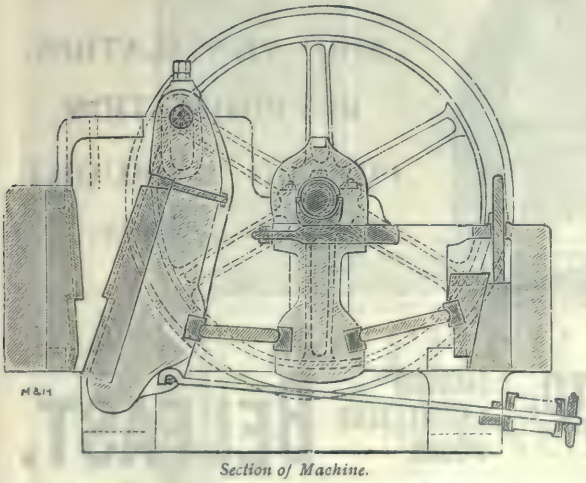

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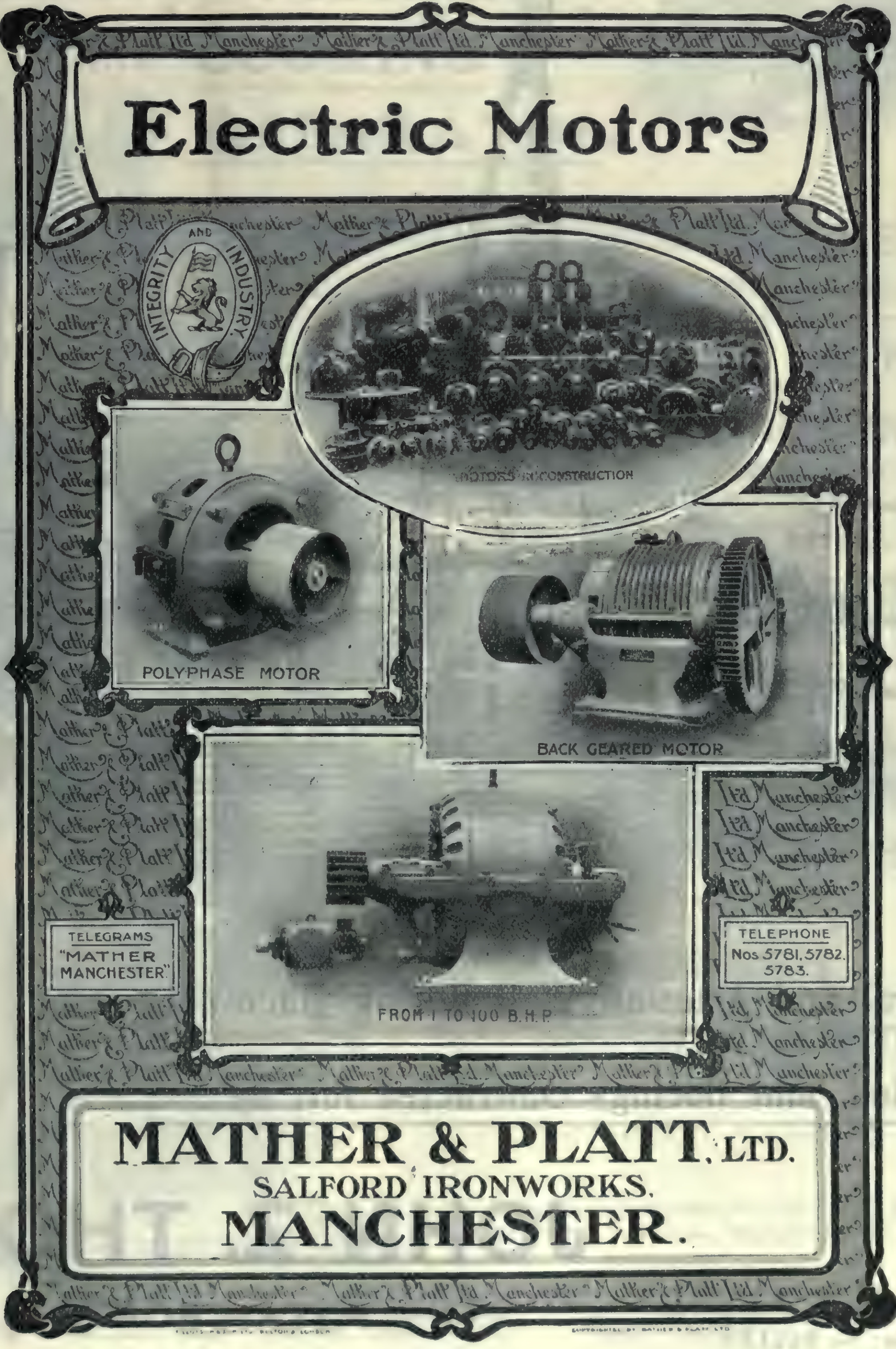

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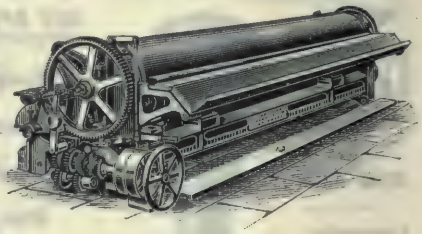

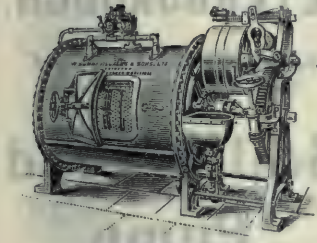

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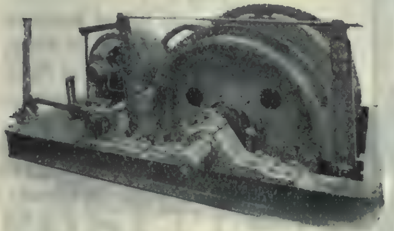

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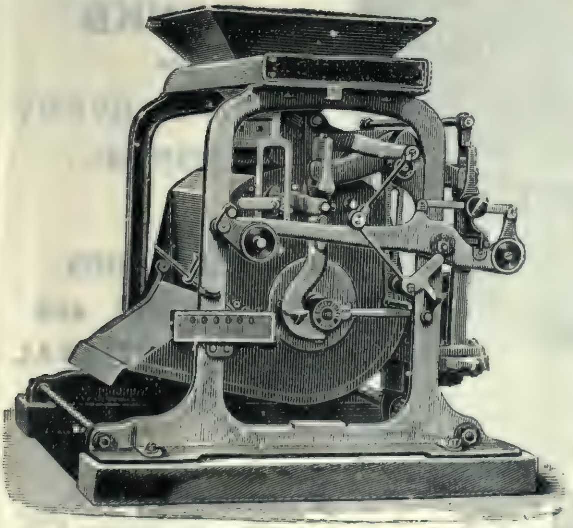

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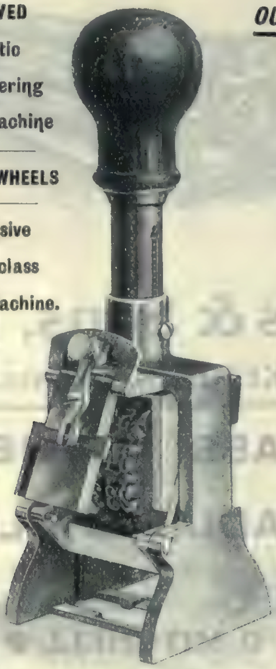

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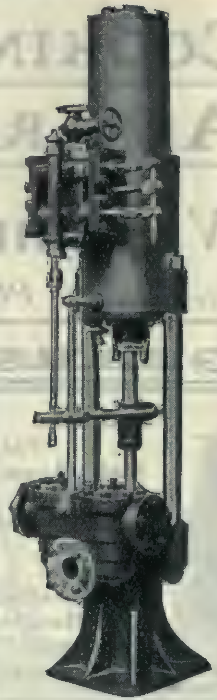

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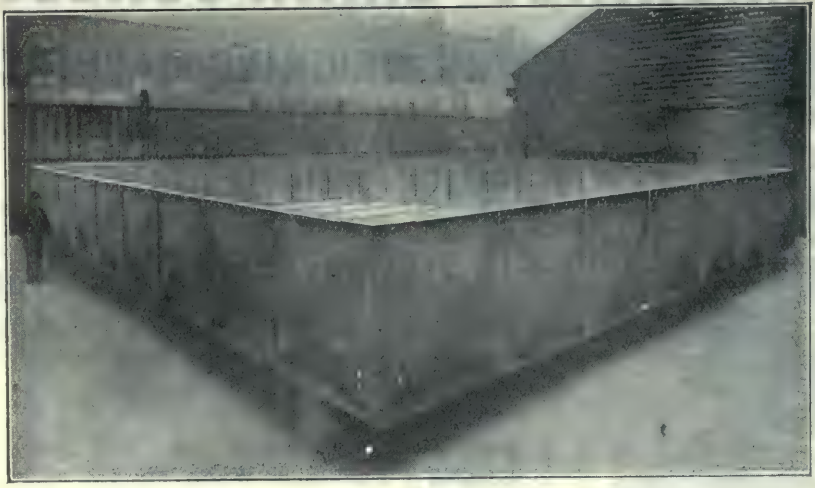

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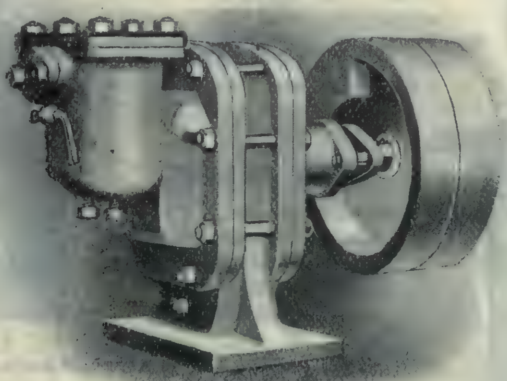

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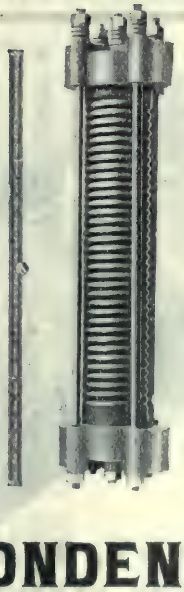

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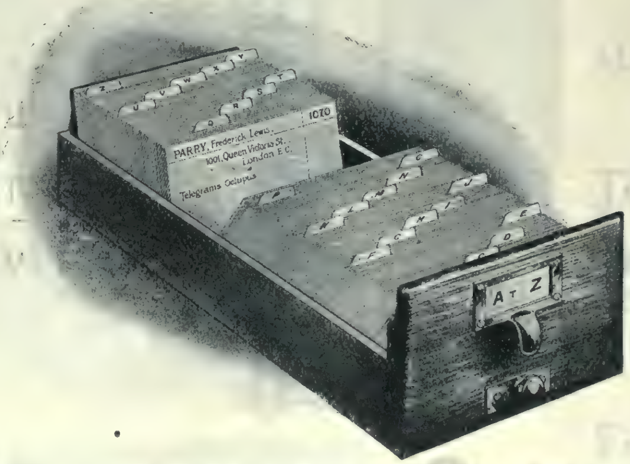

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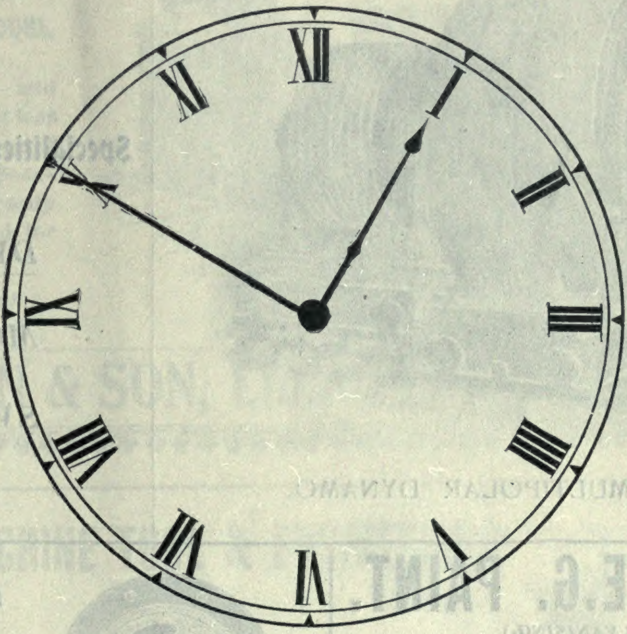

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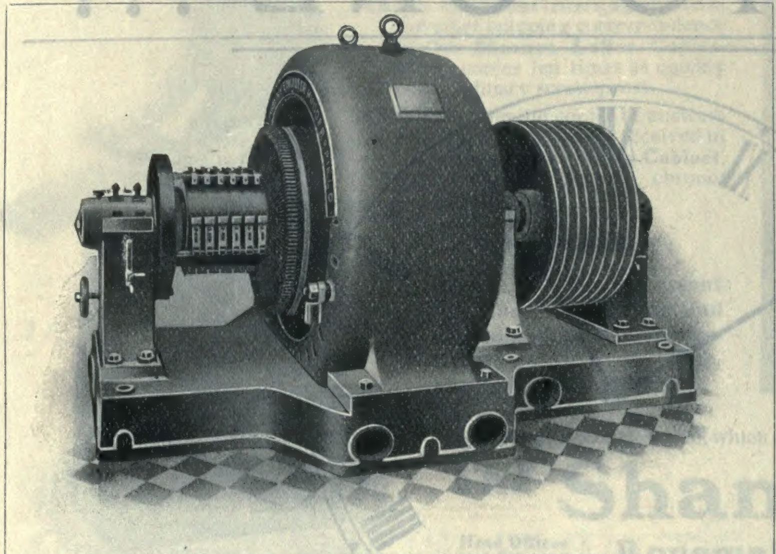

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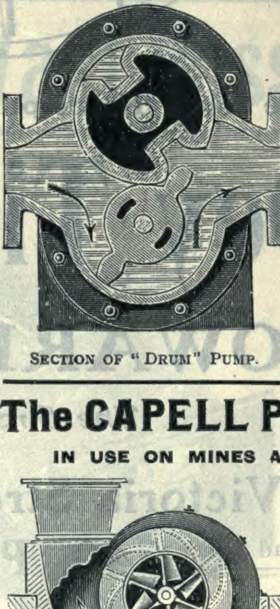

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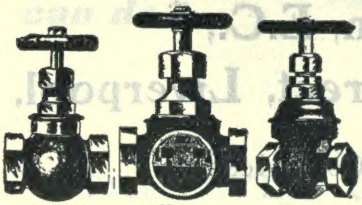
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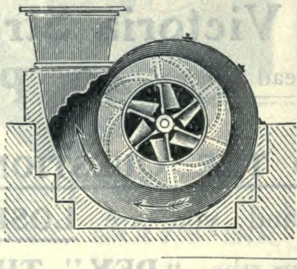

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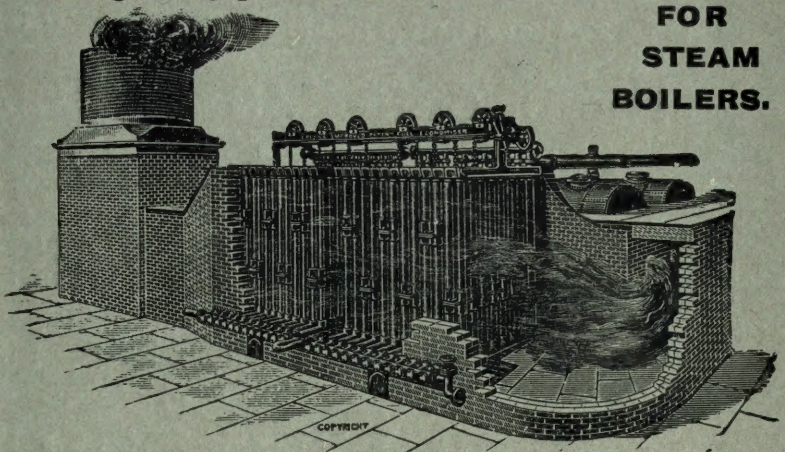

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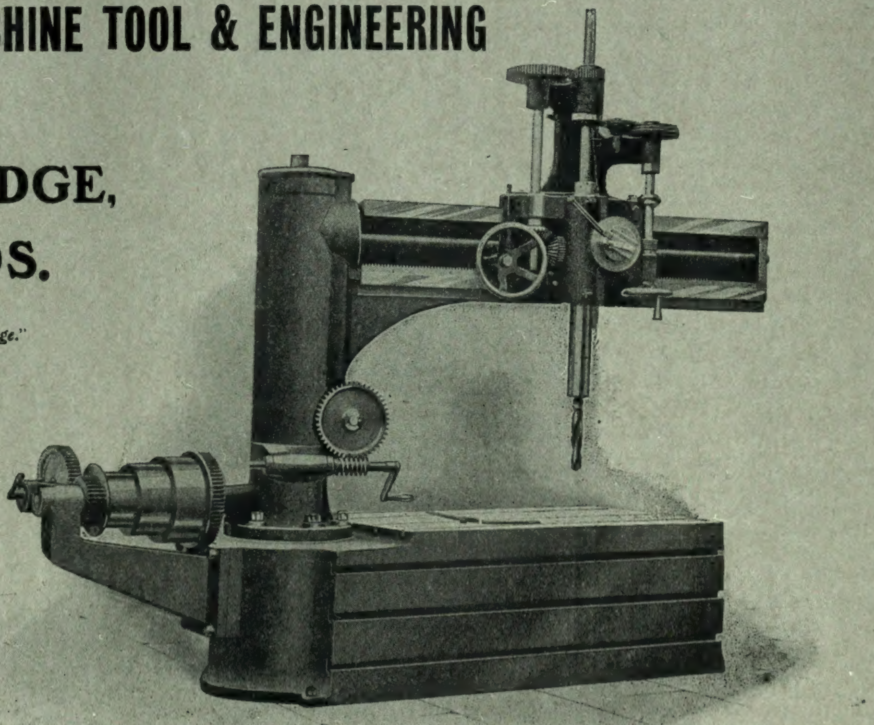

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